APRIL 1961

Volume 56 Number 4

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THIS ISSUE FEATURES SPECIAL MASTITIS CONTROL SECTION

CAN WE CONTROL MASTITIS?---141

A HERD MASTITIS PROGRAM---143

AN UDDER IRRITATION INDEX---147

PET BIRD PRACTICE---157

NEW SWINE DISEASE IDENTIFIED---173

Complete Index on Page 5a

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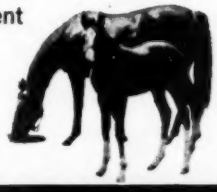

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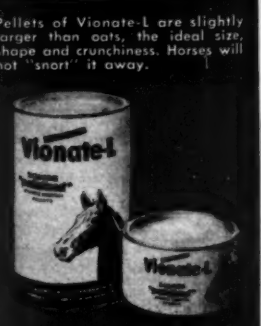

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Can Bovine Mastitis Be Controlled?

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Periodically, it is necessary to re-evaluate the various disease control programs. Progress of the National Brucellosis Program and eradication of other diseases, such as vesicular exanthema, tuberculosis and foot and mouth disease, have lent enthusiasm to other programs. A mastitis control program is one that needs constant evaluation. Most certainly this is one disease that will be controlled but never eradicated.

Since the advent of organized dairying, mastitis has been a constant problem to the dairy industry. Confinement of cattle, increased production and management practices have aggravated this problem, particularly since farm labor has been difficult to train and obtain. The mechanization of milking was thought to eliminate the problem, but in many cases it aggravated the situation because of improper machine use. Research has been conducted on many phases of mastitis, with volumes of literature available on the predisposing factors, etiology, prevention and treatment. Yet various surveys have consistently revealed that 25% to 50% of all dairy cattle have mastitis in some form, sometime during their lactation period.

As far as is known, this incidence still prevails. In various areas in the United States, concerted programs have been instituted in the past to control mastitis. Educational programs, herd service and laboratory aid were instituted to combat the disease. Progress was made in many herds, particularly when herd management practices were improved. In many cases herd infections were controlled only to find more

severe infections developing after a short period of time. In some herds, *Streptococcus agalactiae* was controlled only to find a staphylococcus producing considerably more trouble. Thus, most mastitis control programs have never been complete, or lasting.

Penicillin was heralded as the new drug that would combat mastitis. Its dosage was increased, and in a short time it was supplemented with or replaced by other new wonder drugs. These drugs were "sold" to the dairyman by tremendous advertising and sales promotion programs in the farm press, radio and newspaper. They could be bought anywhere and used as the dairyman chose. Consequently, their use was abused. Treatment was substituted for prevention; in fact, it has been estimated that 75 train carloads of mastitis treatments have been sold annually—a 25 million dollar business. The drugs were not only sold promiscuously, but used so promiscuously that the milk was adulterated with these drugs. This led to suspected and proven human health hazards and, rightfully, regulatory intervention.

Every segment of the dairy industry was rallied to combat this problem. Another "cranberry scare" was about to explode. Tremendous educational programs, milk testing for adulteration and all-out mastitis control programs were instituted in most states. The programs were aimed specifically at preventing milk adulteration and indirectly at mastitis control. Progress reports show that milk adulteration was reduced to a minimum, yet mastitis was still prevalent in many herds and only controlled (temporarily?) in others. Tremendous credit should be given to the educational programs that have been taken to grass roots. When all segments of the industry become aroused, progress will be made to a certain point. The limiting factor is whether we know enough about mastitis to control it.

Confusion, personal theories, and differences in opinions on how mastitis should be handled are some of the bottlenecks that have smothered valuable clues to the program. Most certainly disciplined management, antibiotics and periodic laboratory testing have not completely solved the problem. One question is most difficult to answer: "Is mastitis contagious?" Many (authorities?) still disagree. Possibly the question to be decided is: "How does the infection occur?"

The above comments do not indicate that we should discontinue the use of management practices that are recommended for the control of mastitis, because they are the same practices necessary for the production of quality milk. Nor do we need to discontinue treatments. They are helpful in the control of mastitis. In fact, immunization procedures are receiving renewed interest.

Educational programs, mastitis committees and councils will continue to function. Meetings will be held where prevention and treatment of mastitis will be discussed. We can accomplish a great deal by employing what we know, but the glaring void in all programs is that we do not have enough basic scientific information to satisfactorily control mastitis. The industry awaits this answer.

Yes, we too tire of printing figures such as "175 million dollar annual loss to the dairy industry due to mastitis." How much can we reduce this by what we now know?

A Practical Mastitis Control Program

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This mastitis control program emphasizes the need of bacteriological culturing and incubation up to 72 hours before it is declared negative, properly functioning equipment, dry cow treatment and a record system which selects for mastitis resistance in the breeding program.

Mastitis is one of the major causes of economic losses in the dairy industry. Yet many dairymen fail to recognize this condition either because of its complexity or because of its insidious pattern. With the marginal economic balance in the dairy industry of today, a sound program is needed for its control. Such a program must include a complete diagnostic service, a rational therapeutic regimen and a prophylactic system based on sound management practices.

Mastitis Control Survey

The incidence of mastitis in a herd can be determined rapidly by screening procedures such as the California Mastitis Test, the Whiteside Test and the Hotis Test. Many such methods, however, fail to detect early streptococcal mastitis, thereby leading to a false herd survey. The fastest and best method consists of drawing composite milk samples and inoculating them directly on blood-agar plates. These should be read at 24 and 48-hour intervals, and those with no growth should not be declared negative until 72 hours. Sensitivity tests should be conducted on all bacterial growths.

Bacteriological studies help to determine the source of mastitis; for example, (1) staphylococcal mastitis may indicate overmilking, excessive or faulty vacuum, ill-fitting or over-used teat liners or faulty pulsations. (2) Pseudomonas, Nocardia or coliforms may indicate faulty treatment procedures, wet teat milking or sewage contamination.

In a mastitis control program a veterinarian's service must include a survey of equipment stressing the following requirements:

Milking Equipment: The pulsators should provide about 50 pulsations per minute, with an approximate 50-50 ratio. It should be checked with a portable gauge for quick and definite action between 0 and the upper limit. The pulsator should be designed for ease in cleaning and should be cleaned every 2 weeks if possible.

The vacuum supply lines should be clean. The pump capacity should be about twice the air requirement of the milking units to maintain a level that is correct and stable during milking. There should be a vacuum reserve tank on the pipeline system with a capacity of 5 gallons per milking

Operating 2 units is a full-time job for 1 man.

unit, and it should be located ahead of the receiver jar. A vacuum controller should be located ahead of the trap to allow ease of inspection for cleanliness or for presence of excessive weights. The vacuum line and pipe lines should be completed around the barn in mutiple milking barns.

The milk line should be of correct slope and size with a minimum of 1.5 inches diameter and 1.5 inches slope per 10 feet of line, preferably a low level system. It should have valves that enter the upper half of the line.

The milking unit should be inspected for condition of the rubber inflations and tubing. The stretch liners should have a narrow bore for cleaner milking and less irritation to the teats. They should not be used for more than 700 cow milkings.

Herd Environment: A mastitis control program also includes examination of the herd environment. Obviously, dirty or crowded corrals, manure-soaked pastures, and stagnant water holes contribute to mastitis. The use of low energy roughage or poorly digestible cull products without adequate supplemental grain contributes to general poor health and, inevitably, to mastitis.

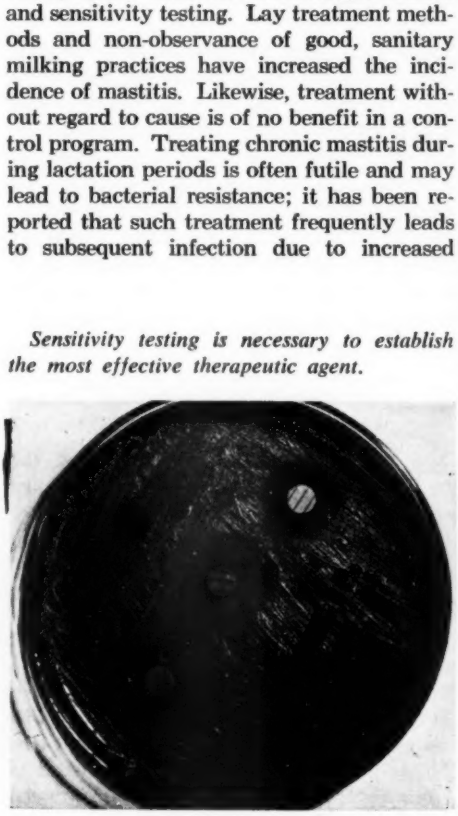
Milking Practices: Probably the most important aspect of udder health is the actual milking, and the most important cog in the milking machine is the human operator. Examples of poor milking practices are: improper priming, over-milking, inadequate care of the cow at freshening, milking with too many machines, failure to remove teat cups as each quarter is finished, use of weights on machines and not stripping or improper stripping.

General Herd Health: Finally, the general health of the herd must also be considered. Leptospirosis, traumatic gastritis, metritis and other diseases contribute to development of the mastitis syndrome.

Treatment Program

A mastitis control program includes sound therapeutics based on bacteriologic studies and sensitivity testing. Lay treatment methods and non-observance of good, sanitary milking practices have increased the incidence of mastitis. Likewise, treatment without regard to cause is of no benefit in a control program. Treating chronic mastitis during lactation periods is often futile and may lead to bacterial resistance; it has been reported that such treatment frequently leads to subsequent infection due to increased

Sensitivity testing is necessary to establish the most effective therapeutic agent.



susceptibility of glandular tissues.[3]

Dry Cow Treatment: For these reasons, dry cow treatment is resorted to mainly. Routinely, individual cows in the herd are sampled during the lactation period using the Hotis Test, the blood-agar plate method, or both. Treatment is delayed whenever possible, until the last few days of lactation, and then individual quarters are treated so that the cow can be turned into the dry lot with the appropriate antimicrobial agent in the udder.

Pre-Lactation Inspection: The dairyman is encouraged to bring the cows into the barn a few days before freshening for a physical examination of the udder. At this time, the teats are inspected for erosions, eversions, papillomas or other defects and the udder is palpated for fibrosis, asymmetry or atrophic defects. Such conditions are treated or corrected if possible.

For antibacterial therapy, nitrofurazone (Furacin Solution, Eaton Laboratories) is used extensively in such programs. The lack of bacterial resistance, its synergism with antibiotics and its tolerance even by sensitive glandular tissues make the use of this drug highly advantageous. Treatment of chronic mastitis has been almost entirely successful with this drug during the dry period. Acute cases are treated during lactation with appropriate intramammary instillations of this agent and with systemic antibiotics. However, when using nitrofurazone during the lactation period, it must remain in the quarter for at least 24 hours in order to obtain maximal bactericidal effect.

TABLE 1

California Mastitis Test Survey of Herds

Month	No. Quarters Tested	No. Quarters Positive	Per Cent Quarters Positive
September 1958	1920	605	31%
March 1959	1900	336	18%
June 1959	1940	272	14%
	Herd Additions		
September 1959	2200	461	22%
October 1959	2264	477	21%
December 1959	2240	628	28%
March 1960	2160	734	34%
June 1960	2120	514	24%

Control Program

In September 1958, a mastitis survey was conducted on a herd of about 500 milking cows. Table 1 shows the results of the California Mastitis Test on this herd, and Table 2 shows the bacteriological culture results. As shown in Table 2, 56% of these cows were infected with mastitis. Using the treatment previously outlined and by culling, the number of infected cows was reduced to 23.5% by June 1959. New animals were brought into the herd in July 1959 and almost immediately the bacteria count began to rise, although the incidence of visible mastitis did not noticeably increase, nor did the California Mastitis Test show any marked increase in infected quarters. The equipment was carefully inspected and nothing was found to be functioning improperly.

Bacteriological Culturing Necessary: At this time, 4 quarter composite milk samples were taken from each cow and cultured on blood-agar plates. The results showed an increase in the number of infected quarters by various bacteria as summarized in Table 2.

An eradication program was started immediately. All infected cows were isolated, separate milking machines were used and

TABLE 2

Bacteriological Culture Survey of Herds

Month	No. of Cows Shedding Organisms	Bacteria and Number Times Found Staph.	Strep.	Colif.	Misc.	Per Cent of Cows Organisms
September 1958	270	111	27	102	30	56 %
March 1959	82	29	8	34	11	13 %
June 1959	114	54	12	34	14	23.5%
		Herd Additions				
September 1959	310	186	34	62	28	56 %
October 1959	566	187	283	56	30	98 %
December 1959	420	188	176	38	18	76 %
March 1960	214	153	21	31	9	40 %
June 1960	113	91	11	8	13	25 %

A sample from each quarter is necessary.

mass treatment was begun on the *Strep. agalactiae* infected cows. Treatment for the chronic cases of staphylococcus and coliform organisms was deferred until the dry period.

Initial treatment consisted of 300,000 units of crystalline penicillin in 30 cc. of Furacin solution per quarter. The cows were not milked for 24 hours. After stripping, the quarters were retreated and milking delayed for 24 hours. This regimen was repeated for a 3rd injection before the cow was returned to regular milking. These cows were resampled at 1, 2 and 3 month intervals and found negative for *Streptococcus agalactiae*. However, they were isolated from the rest of the herd for the duration of the lactation period and were retreated when turned into the dry lot.

In the marginal economy of present-day dairying, the most important aspect of a mastitis control program is prevention of the disease. Any prophylactic program must be based on a system of accurate diagnosis, proper treatment, adequate record keeping and correction of faulty husbandry and equipment. Finally, a program must be based on a breeding selection procedure that aims at genetic improvement of those weaknesses that somehow contribute to development of the mastitis complex.

IBM Records: Without adequate records, it would appear that the best program for control of mastitis might fall short of the desired goal. Furthermore, such records serve as indexes of progress and, therefore, enhance the value of the program.[4] In 2 herds where such a control program is carried out, all data on breeding, production and mastitis sampling are registered in code by IBM. The results of the regular milk samplings are coded and recorded, as are the cow's production, her sire, udder abnormalities and breeding history. Such information is valuable in determining the status of the cows in the herd since those with poor udder attachments, poor udder symmetry and chronic mastitis should be culled. The choice of sires to be used in the herd becomes more than a selection based on production alone; it classifies the sires according to mastitis resistance. This resistance might be classified as anatomic (e.g. udder attachments, teat conformation, teat orifices, supernumerary teats, etc.) or physiological[5] (milk production, per cent butterfat, etc.).

It seems reasonable then that the breeding of dairy cattle should include methods for the proper selection of parents, not on production alone, but perhaps, more important, on the basis of mastitis resistance.

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This paper was presented at an Indianapolis Veterinary Symposium, 1960, sponsored by Eaton Laboratories.

A Herd Irritation Index Using the California Mastitis Test

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Careful milking and preventive management are directly related to successful mastitis treatment and control. In contrast, poor care and careless milking make antibiotic treatment ineffective and disappointing. The quality of the management and milking procedure of a herd can be shown by the California Mastitis Test (CMT) readings, provided due allowance is taken into consideration for the action of infection as determined by culturing or by microscopic examination of an incubated milk sample.

Schalm made available in the California Mastitis Test (CMT),[1] a new tool for evaluating certain symptoms associated with mastitis in a dairy herd. This test was not intended as the sole solution to this most perplexing problem of evaluation, but it does quickly and accurately measure the amount of products of inflammation in milk as it comes from the cow. Leucocytes, the major portion of inflammatory products, are high in protein and when mixed with the CMT reagent form a gel or viscid mass. The degree of gelling is closely related to the number of leucocytes, but some other factors are operative, as certain few samples gel with few leucocytes apparent. Leucocytes may or may not indicate the presence of infectious organisms; however, the shedding of these white blood cells is indicative of an irritation in the udder.

Procedure

The proposed program for mastitis control was presented to the county agent. He and his dairy committee suggested the names of herd owners in the country who might cooperate. The veterinary specialist in extension, the county agent representative and the mastitis specialist visited the farm. In every instance the first owner visited became the cooperator. This approach has been used with over 20 herds with varying degrees of success. The farm and owner are the main variants.

The CMT was used as described by Schalm, with a few modifications of the readings to better suit the needs. The 0 and 2 are the same as suggested by Schalm but T and I are recorded as 1's. The further breakdown of 3 was determined by the gross appearance of the secretion from the udder: if the milk had flakes, clots, or garget, which are discernible before the addition of the reagent, a 4 reading was assigned. These are the abnormal secretions that would be seen on an ordinary strip cup when judiciously used. The 3 reading is recorded when milk and reagent, after mixing and gentle rotation, gather as a viscid mass with a pinnacle in the center.

Modified CMT Readings for Use in Calculating the Irritation Index

CMT	Reaction Appearance and Milk	Ir. Index
0	Liquid, no ppt.	0
T	Trace of ppt. disappears quickly	1
I	ppt. but no gel formation	
2	ppt. thickens and forms toward center	2
3	Distinct gelling adheres to bottom	3
	Discernible flakes and clots in milk	4

A descriptive value called the Irritation Index (Ir.In.) was devised by adding up the individual CMT readings from each quarter of the milking herd and dividing by the number of cows. It would be possible with the numbers we worked with for the Ir.In. to fall anywhere between 0 and 16. Usually, the lower the Ir.In. the better the milking practices. In a sense, the Ir.In. is a measure of the herd situation with respect to inflammation of the udders.

The Irritation Index provided a means for comparing in different herds, or in the same herd at different times, the amount of irritation within the herd which may be due to milking practices, management or infection. The idea and procedure was developed in the course of handling mastitis control demonstration herds in the State of Michigan. Injury from careless milking and handling, which indirectly contributes to the spread of infection and reinfection of a herd, can be detected and measured with the CMT and compared by means of the Ir.In. Thus, Ir.In. helps to establish a better, more effective balance of management and medication in a mastitis control program.

The udder of each cow was washed and milk samples were collected into sterile vials which were incubated at 37 C. for 15 to 18 hours. All of the samples of incubated milk were examined by the direct microscopic procedure described by Bryan[3] and further explained by Drury.[5] When indicated, a tryptose agar plate with 5% of bovine blood from young animals was used for cultural procedures followed by necessary subculturing to establish a species. The reliability of the direct microscopic examination has been shown many times by various workers.[4,5,6,7]

A schedule of visits to the farms was arranged. It was found that best results were apparent when the first 3 were about 2 weeks apart and subsequent visits were on a monthly basis for 4 to 6 months.

The program that was carried out in these demonstration herds consisted of a survey including CMT, milk samples for laboratory diagnosis and discussion with the owner of management practices necessary for minimizing irritation and subsequent spread of infection. The cows with

pathognomonic microorganisms in the udder were treated. The herd was rechecked, ideally, 2 weeks later. The milking procedures were closely observed and appropriate suggestions were offered. A recheck was made again in 2 weeks, and if the Ir.In. and percentage of infected quarters were declining, progress was considered satisfactory. Generally 4 to 6 months were necessary to initiate a program that will minimize mastitis in the herd.

Results and Discussion

Table 1 shows the progress of the mastitis control program in 7 herds which were used for demonstration. The V herd consisted of 20 grade cows milked by the owner. They initially had an Ir.In. of 3.4 and 31% of the quarters were infected. After 4 months the Ir.In. had fallen to 1.6 and the infected quarters to 12%. One month later the herd had an Ir.In. of 1.5, and only 3% of the quarters were infected. The herd continued to have no mastitis problem for many months. The owner had readily accepted our suggestions and adapted them to his routine before we returned for the next visit.

In contrast to the V herd, herd R, which consisted of 36 cows milked by the hired man, initially had 10 first calf heifers and the Ir.In. was low, at 2.3, for the first 2 months. Then the Ir.In. increased up to 4.2 in succeeding months with corresponding infection rates of 17%, 21%, 30% and 27%. This occurred despite treatments with antibiotics for infected quarters following each test. In the 5th test the Ir.In. dropped to 3.6 and the quarter infection to 13%. This was on a test taken 7 days following a herd treatment and indicated that the treatment was partially effective. However, reinfection was apparent 24 days later with an Ir.In. of 3.3 and a quarter infection rate of 29%. After this visit the prescribed program was rigorously followed and resulted in an Ir.In. of 2.7 and a 6% quarter infection rate. Improvement was accomplished by replacing the hired man, reconditioning the equipment and establishing a sound routine for milking. The latter consisted specifically of changing the milking order, use of only 2 machines instead of 3, dipping inflations and teats after milking a cow and attention to each quarter of udder so as to remove inflation when milking was complete.

N herd had no Ir.In. over 1.5 and infection in only 1 quarter at one examination

TABLE 1

Progress of the Mastitis Control Program in Seven Herds

Herd		Months 0	1	2	3	1 Week Later	4	5	1 Year Later
V	Ir. In.	3.4	3.1	3.2	3.7		1.6	1.5	
	% Quarters Infected	31	28	18	15		12	3	
R	Ir. In.	2.8	2.3	3.6	4.2	3.6	3.3	2.7	5.2
	% Quarters Infected	17	21	30	27	13	29	5.8	11
C	Ir. In.	2.7	2.2	3.6	4.4		2.3	3.9	
	% Quarters Infected	25	4	5	9		6	6	
He	Ir. In.	7.2	8.3	5.5	4.8		5.4	....	
	% Quarters Infected	11	10	8	15		5	....	
N	Ir. In.	.5	1.0	1.5	1.5		.8	....	
	% Quarters Infected	0	0	0	2.1		0	....	
O	Ir. In.	5.4	5.4	4.1	4.3		4.6	6.6	
	% Quarters Infected	32	28	17	4.3		15	18	
Ho	Ir. In.	2.3	1.3	0.55	1.5		1.0	0.27	
	% Quarters Infected	30.5	17.7	7.5	20.8		14.5	4.5	

A 3 reading is recorded when the milk and reagent gather as a viscid mass. If the milk has flakes or clots before the addition of the reagent, a 4 reading is assigned.

(this was a newly purchased cow). Strict attention was given to removing milking machines before milking was completed and to stripping the remaining milk by hand. The owner and his high school age son working together as a team did the milking.

The continuously high Ir.In. in the He herd was due to neglect of proper milking procedures. The O herd had a high Ir.In. and also had extensive infection in every sampling. This man was trying to do too much work and consequently did a poor job of milking. An outbreak of acute mastitis among his cows was to be expected. He was reluctant to follow a program that would improve the mastitis situation in his herd. The Ho herd was the best milked and best managed herd in the program. It always had a low Ir.In., and would have had a lower one except for 2 new cows that were purchased and 1 cow that had been dry on the first visit. The latter had an infection which was found after she freshened. Eventually this herd attained a status of negative infection and remained free of infection for several months. This experience points out the importance of careful selection of replacements and the necessity of a bacteriological check of the milk.

Although a 3 or 4 CMT reading from a quarter is not always accompanied by microorganisms in the sample, such a quarter is believed to be predisposed and ready for invasion by many different organisms. On the other hand, CMT "0" does not guarantee that significant microorganisms are absent since there is a delicate balance between host and parasite. However, it does indicate there is only minor irritation and less danger of infection or reinfection of a cow which tests negative in the microscopic examination.

Throughout the records there were many instances of a quarter of the udder being CMT-0 one month, the next month 1, then 2 and 3 the following month. *Staphylococcus aureus* organisms could be isolated frequently from the quarter with the CMT 3 reading. It is also a slow process to bring a quarter down from 3 or 2 to 0. *Staphylococcus aureus* is very prevalent in the environment of cows. It is an opportunist and when the epithelial layer in the udder is damaged, this organism readily invades the udder and may result in infection. First calf heifers will generally classify as CMT "0". Later changes in CMT status depend on how they are managed.

Table 2 illustrates the conditions in 2 herds, as determined by the CMT and by the direct microscopic examination of the incubated milk. The D herd consisted of 92 cows which were milked by machine with institutional help. The local veterinarian was called upon to treat acute febrile cases of mastitis and the persistent obvious chronic cases. There had been no treatment of mastitis for 7 days prior to the sampling time. Eight quarters (Group 3, Table 2) had a grossly abnormal secretion which is classified CMT 4. Of these, 6 had bacterial organisms of significance for mastitis and 2 did not. Five of these quarters shed organisms which were *Streptococcus agalactiae* organisms and 1 quarter had a hemolytic coagulase-positive *Staphylococcus aureus*.

Of the quarters (Group 3, Table 2) in classification 4, 6 had significant organisms and 2 had none. In the CMT 3's, 52 were infected and 24 were negative for significant bacteria. The CMT 2's included 16 with microorganisms and 14 with none, and the CMT 1's, 26 with significant organisms and 14 with none. The CMT "0's" showed 111 with streptococcal organisms and 124 with no apparent significant organisms.

Another herd, C (Groups 4, 5 and 6 in Table 2) demonstrates the improvement possible when extensive programming supported by CMT and bacterial determinations for several months are carried out in a herd. CMT, although not reliable for determining the status of quarters with respect to microorganisms, does indicate irritation and gives data for comparison by the Ir.In. Initially, there was 1 quarter classified as CMT 4 that had no significant bacteria for mastitis, whereas 2 quarters that were 0 had significant bacteria. One year later, after 5 tests, there were 3 quarters that were CMT 0 but which showed significant microorganisms. The last test did not include 5 cows that had been included in the original test but did include 3 new animals.

The results of nearly 9,000 CMT readings (Table 2, Group 7) show that the bacteriological status of the quarter must be measured microscopically or culturally. CMT is only represented as being a measure of products of inflammation which reflects irritation of the udder. Of 282 samples which were so abnormal that they could be detected by an ordinary strip cup examination, 220 had bacterial organisms and 62 did not. There is a possibility that some of the 62 may have been void of organisms because of recent treatment, but such samples were not counted in the totals when such a situation was known.

Among the CMT 3's (Group 7, Table 2) only 685 out of 1,057 so classified were shedding pathognomonic organisms and in the CMT 2's, 400 were infected and 613 were noninfected quarters. Among the CMT 1's there were 234 out of 1,166 quarters that

TABLE 2

The Bacteriological Status of Samples Classified by the California Mastitis Test

Group										
1	CMT Classification	4		3		2		1		0	
2	Direct Microscopic Exam. of incubated milk sample 5% Blood Agar Plate	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.
3	Quarters each class herd #D	6	2	52	24	16	14	26	14	111	124
4	Herd C initially	1	0	8	6	2	8	0	12	2	75
5	Herd C after 6 monthly tests	0	1	1	3	0	28	1	22	2	34
6	Herd C (5 cows sold) 1 year later than 5 above	0	0	2	5	2	12	0	14	3	68
7	Composite of all CMT August 1960	220	62	685	372	400	613	234	932	676	4628

had no significant microorganisms for mastitis. In the "0" classification there were 676 quarters that had significant microorganisms out of a total of 5,304.

CMT is primarily valuable in measuring irritation of the udder in the herd. In many instances in which cows were checked regularly, when irritation increased, infection was soon to follow. Moreover, in herds with the most CMT 0's and 1's, infection was not a great problem and treatments were successful when infection did exist. It therefore seemed desirable to have an index for a herd which Dr. Reed chose to call the Ir.In. to compare situations in herds from time to time, as well as to compare one herd's progress with that of another. The CMT readings furnish the information to place herds on a comparable basis, and the Ir.In. indicates the quality of management of the herd. The Ir.In. as compiled from the CMT is a visible talking point that helps the dairyman understand his problem and progress in preventing mastitis.

Summary

The CMT readings are modified whereby a numeral from 0 to 4 is assigned according to degree of gelling of strict foremilk samples from cows. From the CMT readings an Irritation Index is calculated which indicates the herd situation with respect to udder irritation.

The results and progress obtained in working with several herds are discussed. Over 9,000 CMT readings were compared to findings of direct microscopic examination of incubated milk and many were checked against blood tryptose agar plates. The results are such that treatment of a quarter with drugs should never be based on a single CMT reading.

Journal article number 2756, Michigan Agricultural Experiment Station, East Lansing, Michigan.

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Concentration, Persistence and Diffusion Of Penicillin G in Milk and Blood After Intramammary Infusion

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Adulteration of milk with antibiotics is a great problem to the dairy industry today. Persistence of antibiotics in milk of infused quarters and diffusion to untreated quarters are problems commonly bothering the dairyman. In this study it was found that penicillin G does diffuse to untreated quarters and persisted an average of 33.5 hours. Residues of oil-base preparations remained in intramammary infused quarters 84 to 96 hours, while aqueous base preparations persisted 48 to 72 hours.

Antibiotics in milk constitute a hazard to public health. The concern of federal, state and local health agencies pertaining to antibiotic residues is not new, although attention has been drawn more specifically to this problem as a result of recent food-additive legislation.[2,4,13] Penicillin has been found more often than other antibiotics in market milk.[2,4,13,14] By law there is no tolerance for the adulteration of milk with penicillin or other antibiotics. Antibiotic residues persist in the milk of treated cows for varying periods of time. Plastridge[11] summarized the results of several studies showing a wide variation in duration and concentration of levels of penicillin in the milk after treatment with 100,000 and 300,000 units of penicillin in an oil base. Hansen *et al.*[5] reported contamination of milk from 4 to 6 days after udder treatment with 100,000 units of penicillin. Similar results have been obtained after udder infusion with oxytetracycline[6,10] and chlortetracycline..[8,10,12] After antibiotic treatment federal agencies recommend that milk should be discarded or used for purposes other than human consumption for at least 72 hours after the last treatment.[2,4,13,14]

Limited data have been published regarding diffusion of penicillin from treated to untreated quarters. Blobel[3] reported transfer of penicillin from treated to untreated quarters after infusion of doses of 100,000 and 300,000 units per quarter.

Kastli[9] discussed the possibility of antibiotic penetration from treated to untreated quarters; however, he found no measurable amounts present in untreated quarters of

Published with approval of the Director, Wyoming Agricultural Experiment Station, as Journal Paper No. 160.

the same udder. The purpose of our investigations was to provide additional information on antibiotic concentration, diffusion and persistence in the blood and milk of cows after intramammary infusions with varying amounts of penicillin.

Experimental Procedure

Lactating Holstein cows from the university dairy herd were selected for the various treatments. Small groups were selected for administering varying doses of penicillin preparations. Udder infusions were administered after complete milking of the cows. Treated quarters were not milked out until 24 hours after treatment. The data were obtained at intervals during the months from March to July 1960.

Results and Discussion

Preliminary trials were made with 9 cows to determine persistence and diffusion of penicillin in both treated and untreated quarters of the same udder. During the initial trials, ½ inch discs were used for the assay analysis and readings were interpreted as positive or negative with no measurements of inhibitive zones. It was estimated that the sensitivity of the ½ inch disc readings of slightly positive would range from 0.01 to 0.03 units/ml. and be comparable to ¼ inch disc interpretations at the 0.05 level. The more sensitive test, using ½ inch discs, would account for the longer duration of residue shown in this trial. All subsequent trials were made with ¼ inch discs in accordance with the procedure used by the Federal Food and Drug Administration.

Data from the preliminary trials show no relationship between mastitis and persistency of penicillin in the milk or between low and high producers and persistency. The results also demonstrated that diffusion of penicillin from treated to untreated quarters of the same udder is more complete after large doses of 500,000 units as compared with the 100,000 unit dose.

Data in Table 1 show the relationship between the concentration, diffusion and persistence of penicillin in blood and milk after administration of the aqueous and oil preparations infused in light, heavy and repeated doses.

After administration of penicillin G in either the aqueous or oil base, there was considerable variation in the levels of this drug in both blood and milk from the different cows. Administration of the drug in 100,000 or 500,000 units or in repeated treatments appeared to make little difference in antibiotic concentration of blood and milk. Similarly duration time varied with different cows regardless of size of dose used. Our results differ from those reported by Gessert,[3] quoting the belief of Food and Drug officials that smaller doses disappear more quickly from the milk. Penicillin persisted longer in the milk from cows administered the oil-base type. Duration time ranged from 48 to 72 hours and 84 to 96 hours for aqueous and oil-emulsion types respectively.

Table 2, showing a summary of concentration, diffusion and persistence of penicillin G in blood and the milk of untreated quarters after intramammary infusion, is presented separately in order to make a more complete analysis of the diffusion or transfer phase of our studies presented in the preceding tables.

Diffusion of penicillin from treated to untreated quarters of the same udder is more complete after large doses of 500,000 units as compared with the 100,000-unit dose. Average concentrations in units/ml. of milk are also slightly higher after large doses. There is a wide range in persistence of the drug in milk of untreated quarters, from 24 to 60 hours, with an average of 33.5 hours. The data indicate no relationship between duration time and size of treatment; in fact, results show less concentration and persistence in blood and milk after repeated heavy infusions. We may assume that there is no build-up of penicillin in the blood or udder tissues and that the drug is rapidly absorbed by body tissues. We also assume that the diffusion of penicillin

TABLE 1

Concentration, Diffusion, and Persistency of Penicillin in Milk and Blood after Udder Infusion

Group 1 — Single Infusion — 500,000 Units — Penicillin G — Aqueous
(Sensitivity of Zone readings in Units/ml.)

Cow No.		Treated	HOURS 2 Milk	2 Blood	12 M	12 B	24 M	24 B	36 M	36 B	48 M	48 B	60 M	60 B	72 M	72 B	84 M	84 B	Milk Prod. lb./day
	LF		1.0		1.0		1.0		0.1		0.05		0						
21	LR		0	0.05	2.0	0.1	0.05	0	0.1		0		0						20
	RR		0		0.05		0		0		0		0						
	RF	X	>100		50		4.0		2.0		.05		0						
	LF	X	>100		20.0		2.0		0.5		0.5		0						
43	LR		0	0.5	2.0	0.1	0.1	0	0	—	0	—	0						25
	RR		2.0		2.0		0.5		0.1		0.05		0						
	RF		0		0.1		0		0		0		0						
	LF		0		8.0		0		0		0		—						
7	LR		8.0	0.08	2.0	0.5	0	0.1	0	0.08	0	0.01	—	0					18
	RR	X	>100.0		100.0		100.0		4.0		3.0		0						
	RF		8.0		2.0		0.8		0		0		—						
	LF		2.0		8.0		2.0		0		0		—						
59	LR	X	3.0	0.5	2.0	1.0	0.1	0.1	0	0.1	0	0.1	—	0					32
	RR		2.0		0.5		0		0		0		—						
	RF		0.5		0.05		0.05		0		0		—						
			3 Infusions — 500,000 Units — Penicillin G — Aqueous																
	LF		0		0		0		0		0		0	0	—				
41	LR		0	1.0	0	0		0	0		0		0	0	—				39
	RR		0		0		0		0	NS	0		0	0	—				
	RF	X	NS		>100.0		30.0		3.0		2.0		0.5	0	0				
	LF	X	NS		>100.0		10.0		2.0		0		0	—					
93	LR		0	0.05	0	0	0	0	0	NS	0		0	—					31
	RR		0		0		0		0		0		0	—					
	RF		0		0		0		0		0		0	—					
	LF			*	0.9		0		0		0		0		0				
12	LR		NS	NS	1.0		0		0		0		0		0		0		31
	RR				0.2		0		0		0		0		0		0		
	RF	X			100+		50.0		3.0		2.0		1.0		0.05		0		
	LF	X			100+		50.0		30.0		1.0		1.0		0.05		0		
33	LR		NS	NS	0		0		0.05		0		0		0		0		
	RR				4.0		0		0		0		0		0		0		
	RF				1.0		0		0.05		0		0		0		0		
			Single Infusion — 500,000 Units — Penicillin G — Oil Emulsion																
	LF				0		0		0		0		0		0		0		
14	LR				3.0		0		0		0		0		0		0		28
	RR	X	NS	NS	100+		30.0		10.0		1.0		1.0		0.05		0.03		
	RF				1.0		0.05		0		0		0		0		0		
	LF				3.0		0		0		0		0		0		0		
48	LR	X	NS	NS	100+		100+		10.0		2.0		1.0		0.05		0.03		38
	RR				2.0		3.0		0		0		0		0		0		
	RF				0.2		1.0		0		0		0		0		0		

*Blood samples not taken

NS — No samples taken

NOTE: Cow #59 — weak sphincter muscle — much of antibiotic leaked out.
Cows #41 and #93 — showed diffusion concentrations similar to #7 and #59 for first 24 hours after 1st and 2nd infusions.

TABLE 2

Diffusion, Concentration, and Persistence of Penicillin G in Blood and the Milk of Untreated Quarters after Intramammary Infusion

No. Cows	Treatment	Diffusion	Concentration *u/ml. at 12 hr.*				Duration Range Hr.	
			Milk Range	Avg.	Blood Range	Avg.	Milk	Blood
9†	100,000 units aqueous	6 cows — 1 or more quarters	—	—	—	—	Avg. 36 24-48	—
4	500,000 units	All untreated quarters	0.05-8.0	2.3	0.1-1.0	0.42	Avg. 48 36-60	Avg. 42 24-60
3‡	500,000 units aqueous repeated doses	All untreated quarters	—	—	—	—	Avg. 36 24-48	—
2	"	None*	0	0	0	0	—	12
2	100,000 units in oil	5 of 6 untreated quarters	0.2-4.0	1.42	N.S.	N.S.	24	N.S.
2	500,000 units in oil	All untreated quarters	0.2-3.0	1.84	N.S.	N.S.	36	N.S.
19	Total	Average	0.05-8.0	2.0	0.1-1.0	0.42	33.5	32.0

†—Includes cows in Group 3 — first 24 hours, administered 100,000 units in 1st treatment.

‡—Data recorded after last treatment.

*—Concentration and duration for these 2 cows following the first and second infusions were similar to those shown for Group 2.

from treated to untreated quarters is via the venous system and secretory tissues rather than by direct infusion through the udder tissue. Blobel[2] found that the blood stream played a major role in this transfer. Hollister *et al.*[4] reported that the following parenteral-treatment antibiotics diffuse from blood into all mammary tissues and theorized that systemic treatment was more effective in reaching all parts of the udder. Our assumption is supported by the fact that quarters in the same half of the udder as the treated quarter have shown no greater concentration or duration than those in the untreated half. Further analysis of the data shows no relationship between penicillin concentrations in the blood and milk of untreated quarters.

Summary

Lactating cows were administered varying amounts of penicillin G with aqueous and oil base. The cattle were given various administrations in small groups over a period of 4 months. Antibiotic levels were measured by the disc-assay method recommended by the Food and Drug Administration with sensitivity at the 0.05 units/ml. level and higher.

After intramammary infusion the data showed wide variations among individual cows in milk and blood concentrations, diffusion to untreated quarters and persistence of the drug. The amount of penicillin G administered appeared to make little difference in concentration or persistence, but did in diffusion. Similarly, no relationship was observed between cows with mastitis infections and controls, or between high and low producers. Oil-base preparations displayed greater persistence (84 to 96 hours) over the aqueous base (48 to 72 hours) for treated quarters. The experiment demonstrated that penicillin diffuses from treated to untreated quarters of the same udder. Concentrations of the drug ranged from 0.05 to 8.0 units/ml. in milk and from 0.1 to 1.0 units/ml. in blood with no apparent relationship be-

(concluded on page 180)

Problems Encountered in Pet Bird Practice

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In this country we have 15 million parakeets and 7 million canaries, or 1 pet bird in every 4th home, and this figure is still increasing. The increasing popularity of pet birds is due to our economic system. Apartment dwellers and our large, aged population find birds the ideal, least burdensome pets. Landlords may not allow dogs or cats, but have no objection to birds. But most of all, pet birds are very appealing. They are sociable, beautiful and intelligent. They are eager to please and it is a pleasure to own and care for such a pet.

The Challenge

When one compares this 22 million figure with our dog and cat population of about 26 million each, he can easily recognize the great potentialities a pet bird practice offers.

Our clinics or veterinary hospitals are ideally suited for the handling of birds. We already have the necessary surgical instruments and equipment, and most of the drugs needed can be found on our drug shelves. The fees charged for our services are comparable with those of our 4-legged hospital patients. Because of considerably less expense in the housing, feeding, handling, labor, and the very minimal cost of medicines, a pet bird practice can be developed into a very lucrative segment of a practice. Indeed, in a pet bird practice, we are mostly repaid for our knowledge rather than for medicines used or dispensed.

The biggest problem is that we, as individual veterinarians, may be apprehensive about handling and treating birds because we are afraid that we do not have the knowledge and qualifications to do so. But remember that most of the principles

and procedures of veterinary medicine may be applied here. We do have a great deal of comparative knowledge. We have been trained in comparative anatomy and physiology and in the anatomy of the chicken. Our powers of observation and diagnoses are acute. We are surgeons and, in short, veterinarians and there is no other group better prepared or qualified.

Diagnosis

Birds have a very excitable temperament and special care is required in handling them. Upon its arrival at your establishment, place the bird in a quiet room and allow it time to quiet down before attempting an examination.

History: This is a good time to take the pet's history. Has the bird been recently acquired? How old is it? Is it a male or female? What are its eating habits? What about its present and past appetite?

Symptoms: Next, observe the bird in the cage and watch its actions. While doing this, keep in mind the cardinal symptoms of bird illnesses: listlessness, ruffled feathers, loss of appetite or ravenous appetite, diarrhea, an increase in the respiratory rate (85 times per minute is normal), emaciation, weakness and coma.

Droppings: The color and consistency of the bird's droppings may be an important aid in arriving at a diagnosis. Normal fresh droppings consist of a firm, black ring with a soft, pure white center. The black part is feces, the white part is urine. Any change from the white color of the urine usually indicates some pathological condition. Remember that feces can be affected in color and consistency by the nature of the food consumed. As a rule, watery or pasty droppings intermixed with white urine suggest diarrhea and enteritis. Because such droppings are usually strongly acid, they are apt to irritate the vent and cause the bird to whip its tail after each passage.

In most febrile or infectious diseases, the droppings are usually yellow in color during the initial stage. In fowl cholera, typhoid and psittacosis, the yellow color will change to green as the disease progresses and droppings will finally become bloody during the chronic stage or during the terminal stage. In diphtheria or fowl pox, the color will change from yellow to brown as the disease progresses. In pneumonia, droppings are usually brown, dry and scanty. In pullorum and coccidiosis, they are grayish-white, thin and watery. In nephritis, they are gray and gummy.

Examination: If a close examination is necessary, remove the bird from its cage. To do this, introduce the hand slowly into the cage and grasp the bird over the back. Hold it in the palm of your hand with the head and neck secured between the thumb and forefinger. Conduct a manual examination with the other hand, exposing only one part at a time. Is the bird too light or too heavy? Examine the feathers, crop and abdomen. Are any tumors present? Is the bird egg-bound? Take the temperature only if absolutely necessary, as it will greatly excite the bird. The normal temperature is 106 to 107 F. The normal heart beat ranges from 300 to 500 times per minute, but may greatly exceed this rate during excitement and is unreliable for diagnostic purposes.

Consider all facts and findings in connection with the history and environment. If a diagnosis is made at this time, it is well to give any needed medication before the bird is released.

Some Drugs and Dosage

Vitamins: Thiamine HCl, 1 mg. once daily for French molt; wheat germ oil, 1 minim; Pervinal (U. S. Vitamin Corp.) or Vitamycin (Pitman-Moore), 1 grain in a teaspoon of seed daily.

Digestive Disorders: Mineral or olive oil, 1 to 3 drops on the first day; sulfaguanidine, 1/10 grain orally daily; bismuth sub-

nitrate, 1 grain orally daily; aqueous penicillin, 5,000 units orally or I.M. into the pectoral muscle daily; Kaopectate (Upjohn), 2 drops orally daily.

Respiratory Disorders: Panmycin Aquadrops (Upjohn) or oral tetracycline, 1 drop daily; Neoprontosil (Winthrop), 1 minim subcutaneously into the web of the wing; sulfathiazole, 1/20 grain orally daily for 2 days only; sulfamethazine (12.5%) make a 1:1,000 solution by placing 1 cc. in 4 oz. of drinking water.

Infectious Diseases: Broad spectrum antibiotics, 1 mg. to 2 mg. four times daily; 8 mg. in a teaspoon of seed. (Continue this for 4 days in therapeutic treatment of psittacosis; for prophylactic treatment, mix 30 mg. in ¼ lb. of seed.)

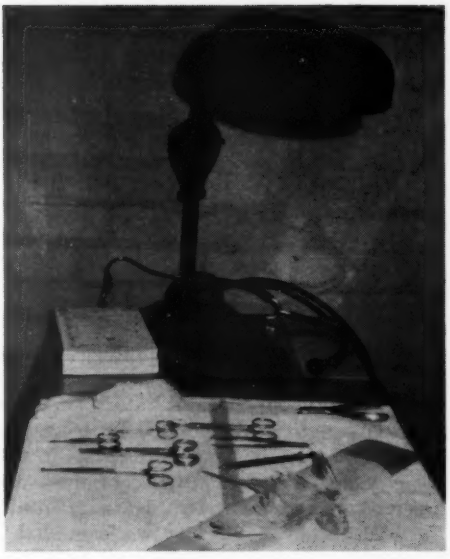
External Parasites: Scaly leg mite, apply Polyderm (Warren Teed) with cotton-tipped applicators once daily; Red mite and lice, pyrethrum reduced to 3% with talcum powder dusted on the bird daily and scrub cage with chlordane or Phostix (Fort Dodge), 1 ounce in 1 gallon water.

Hemorrhage: Monsel's solution (ferric subsulfate), apply to bleeding beak or toenail if trimmed too short.

Caution: Do not use procaine, procaine penicillin or DDT, as they are toxic to the bird.

Anesthetics: Ether is suitable for brief anesthesia. Keeping in mind the short duration of anesthesia, all instruments and equipment should be held in readiness. The bird is held in the recumbent position and ether is sprayed from a 2 cc. syringe equipped with a 26 gauge, ¼ inch needle, directly into one nostril from a distance of about 1 inch. Administration is stopped as soon as the bird stops struggling and is resumed at intervals when the bird begins to regain consciousness, depending upon the length of the operation.

Ethyl chloride is administered from a tube equipped with a fine spray nozzle and is used similarly to ether for brief anesthesia by intermittent application. Its safety margin is greater than that of ether when used on birds.



The parakeet is anesthetized with Equi-Thesin and taped to a yucca board for surgery.

For more time-consuming operations, Equi-Thesin (Jen-Sal), may be preferred. The dosage is 0.25 cc./100 gm. of body wt. The average parakeet weighs about 35 gm. and would require about 0.08 cc. of Equi-Thesin injected into the pectoral muscle. Use a 1 cc. glass T. B. syringe with a 26 gauge, 3/8 inch needle. A canary weighs about 20 gm. If you have a dispensing scale or postal scale, it is worth while to place the bird into a paper container and ascertain its exact weight. The anesthetic stage will be reached in about 5 to 15 minutes and lasts about ½ to 1 hour.

Nembutal or pentobarbital sodium may be used in a diluted form. Standard Nembutal contains 1 gm. or 60 mg. of the drug per 1 cc. of solution. Dilute 1 cc. of Nembutal with 8 cc. of distilled water. This gives a concentration of almost 7 mg./cc.

For a 35 gm. bird, inject 0.2 cc. of this diluted solution into the pectoral muscle or into the abdominal cavity with a 26 gauge needle. This dose would be equivalent to almost 1½ mg. of the drug. The anesthetic stage is reached in 2 to 3 minutes and lasts for about ½ hour. Equi-Thesin is the safer of the 2 drugs.

Anatomical and Physiological Differences

Several anatomical and physiological peculiarities of birds create problems. One of these is the air sacs. In addition to the lungs and bronchi, the respiratory capacity of a bird is greatly increased by a system of air sacs, air tubes and air cavities in the principal bones. The purpose of this vast air communication system is to maintain the equilibrium of the bird while in flight, to enable it to make adjustments to differences in atmospheric pressure and to assist in the elimination of heat since birds have no sweat glands.

It is important that we know the approximate location of these air sacs in order to avoid them when giving hypodermic injections or fatal results may occur. There are 11 air sacs, which are named according to their location: 2 cervical, 1 clavicular, 2 axillary, 2 anterior thoracic, 2 posterior thoracic and 2 abdominal. The air ducts are communicating passageways between the bronchi and the air sacs, and even extend beyond them to the air cavities in the bones and throughout the body as far as the quills of the feathers. Their orifice may be as narrow as 8 microns (about the size of a human red blood corpuscle).

Occasionally, an air tube or an air sac may rupture and the escaping air may accumulate subcutaneously. The affected portion or even the whole body may puff up, giving the bird a grotesque appearance. This condition may result from mechanical injuries or may be associated with some respiratory or air sac infection. The air should be drawn off by inserting a 26 gauge, 3/8 inch needle through the skin 2 or 3 times daily, or by creating a small fistula and then the proper steps to remedy the original cause should be initiated.

The crop is an expansion of the esophagus and is equipped with a large circular muscle. Here the food is stored and moistened. The crop permits a bird to eat a large amount of food and to digest it later. It is prominent in parakeets, almost absent in canaries.

Due to their high rate of metabolism and their high temperature, caged birds burn up their food rapidly and consequently have large appetites. A parakeet will consume nearly 100 times its own weight per year in seed and water. He will eat 1 to 2 teaspoonfuls of seed, drink 1 to 2 teaspoonfuls of water, and pass about 40 droppings daily. The expression "eating like a bird" when applied to humans is incorrect. To equal the records of our little feathered friends, the average man would have to eat 45 lb. of food daily.

The basic diet for canaries consists of equal parts of canary and rape seed. Parakeets should receive 50% canary seed, 40% millet or hemp seed and 10% hulled oats. Grit such as sand or small gravel should be available to allow for proper functioning of the gizzard. Oyster shell, egg shell, bone meal or cuttlebone should be available as a source of calcium. Greens such as lettuce, pieces of carrots, tomato or apple will also be appreciated. Fresh water should be available at all times.

Occasionally, a parakeet may swallow some coarse, long-fibered piece of material such as grass or a piece of string or even a large seed hull that will not pass the crop. Or the ingested food may have been moldy or stale. This may result in an impaction of the crop. The crop becomes greatly enlarged, pendulous and distended with food. The bird is in distress, vomits and if not relieved, it will quickly die from suffocation due to pressure of the impacted material upon the trachea. Or it may perish in a few days from undernourishment because food cannot pass through the esophagus.

The removal of the impacted material

is not always easy. All seed and water is withheld for 2 hours. Three drops of mineral oil or some physiological salt solution are administered orally. The crop and its contents are massaged with the thumb and index finger in an upward motion in an effort to loosen and evacuate the material through the mouth. A blunt probe may be passed down the esophagus into the crop to agitate the contents.

If this procedure will not relieve the condition, surgical intervention will be necessary. The bird is anesthetized, the feathers are plucked from the crop area and an incision about ¼ inch long is made through the skin only, parallel to the grain of the skin. The crop is then rotated so that its upper and opposite portions face the skin incision. Here the crop is incised and the impacted material is forced out through the 2 incisions. The crop is then irrigated with warm saline solution and allowed to return to its original position. This procedure of making 2 incisions, not facing each other, eliminates the necessity of suturing and reduces the danger of adhesions. The bird should receive a soft diet such as mash or Pablum for a week following surgery.

An obstruction of the gizzard is a rare occurrence in parakeets due to the fact that the crop acts as a safety valve. Any seed hulls or foreign objects are more apt to become imbedded in the crop prior to reaching the gizzard. If they should reach the gizzard, they will be ground by the grit and stones contained there. Even canaries, which do not have a crop, are only seldom afflicted.

Reproduction

The sex of the parakeet can be determined by the color of the cere. The cere is a soft, fleshy membrane at the base of the beak and surrounding the nostrils. In the mature male bird, the cere is a distinct blue color, while in the mature female it is whitish-tan or brown. However, in baby parakeets the color of the cere is the same light pink to blue in both sexes.

It is difficult to differentiate between a male and a female until they are 3 to 4 months old. After this age, the male parakeet, in addition to the blue cere, may also be recognized by his prominent full chest and pear-shaped body, the bright coloring of his feathers and by his ringing song. The female parakeet has a whitish-tan or brown cere (the cere may also be brown in a sick male bird), the abdomen is more oblong than in the male, the chest is smaller, the coloring of the feathers is not as pronounced and it is not as apt to sing. Canaries have no cere, but the other distinguishing characteristics apply.

Parakeets and canaries are tropical birds and if allowed will breed at any time of the year. It is advisable to permit only 2 or 3 hatchings per year from each pair. The parent birds should be at least 1 year old. The female parakeet lays from 4 to 6 eggs at the rate of 1 egg every other day. Incubation begins when the 1st egg is laid and takes 18 days. The babies are hatched every other day, usually early in the morning, at a very immature stage of development. They are naked and cannot see until they are 10 days of age.

The parakeet parents feed them crop milk for the first 3 to 4 weeks. This is regurgitated food intermixed with a special crop secretion. During courtship the male parakeet will feed the female partner crop milk. He may try to bestow similar affection upon his owner. The secretion of crop milk may also occur if the male bird is being deceived by a mirror in his cage and thinks that he sees a female bird.

The ugly baby develops quills in just a few days. Coloring of the feathers begins to show after 12 to 14 days. At 4 to 5 weeks of age the feathering is almost complete. The bird can then take care of itself and should be separated from its parents.

Canaries will lay a total of 4 eggs. Incubation begins when the last egg has been laid and the babies will all hatch on the same day 15 days later. Canaries have no crop and do not secrete crop milk.

The large intestine, the ureters, the vas deferens of the male and the oviduct of the female empty into a common pouch, the cloaca. The cloaca plays an important part in mating, since the male sperm are deposited here. It also functions during delivery of the egg. It is at this location that the principles of veterinary obstetrics must be applied should we be confronted with an egg-bound condition, or with a prolapse of the oviduct.

The female reproductive organs include only a single ovary and oviduct, usually located on the left side. The right ovary disappears early in life and the right oviduct remains rudimentary. The yolk or ovum is drawn from its ovary into the upper end of the oviduct by the action of lashing cilia. It is surrounded with layers of albumen and 2 soft membranes while it travels down the oviduct. Sometimes a bird will lay such a soft-shelled egg, but under normal conditions a layer of egg shell is secreted around the soft membranes by lime-producing glands in a diverticulum in the lower part of the oviduct. Most egg-bound conditions occur either at the diverticulum or beyond, near the sphincter muscle at the entrance to the cloaca.

The causes of an egg-bound condition are as varied and numerous as are those encountered in any other field of veterinary obstetrics: immaturity of the bird, underdevelopment, inflammation of the oviduct and cloaca, constriction of the sphincter muscle, malformation of the egg and tumors. The symptoms are stiff-leggedness, distress, prolonged and ineffective labor. Due to constant straining the cloaca becomes inflamed, the bird becomes exhausted and will die if no help is given soon. The egg can be palpated in the lower abdomen and may be differentiated from tumors by its size and shape.

To deliver the egg, the bird is turned on her back and the cloaca is lubricated with warm mineral oil. A short-lasting anesthetic, such as ethyl chloride, is administered. While the bird is in this relaxed condition, the operator with his thumb and forefinger, grasps the abdomen at a point just behind the egg. Constant and gentle pressure is applied. The egg is gradually forced toward the cloaca and the vent. Once the egg is visible, a drop of mineral oil is applied to its end and the pressure is relaxed to allow the egg to retreat slightly. Pressure is resumed and the egg will usually be delivered without further difficulty.

In cases of a broken egg or where it becomes imperative to break it, use a pair of mosquito forceps to dilate the cloaca and the distal portion of the oviduct. With a gentle amount of pressure, as described before, it will usually be possible to remove the broken pieces of shell with the forceps.

Occasionally, a delivery is complicated by the prolapse of the oviduct. If this has occurred, it may be necessary to incise the oviduct in order to remove the egg. The prolapsed portion is then bathed in warm physiological salt solution. With a pair of mosquito forceps and a blunt probe, the prolapsed portion is carefully replaced and induced to remain in place by infusing about 1 to 2 cc. of warm physiological salt solution. The vent may be closed with 2 silk sutures (4-0) for 2 to 3 hours. Aqueous penicillin is administered intramuscularly at the rate of 5,000 units b.i.d. for 2 days.

This is the first of a two-part discussion on the problems of a pet bird practice. The paper was presented at the 38th Annual Postgraduate Conference for Veterinarians at Michigan State University.

Small Animal Clinic

Canine Ophthalmology: Useful Practice Facts

Unlike the human eye, the epithelium, stroma and endothelium of the canine eye are all capable of spontaneous regeneration. This is the reason canine corneas will heal without scarring even after deep penetration. Descemet's membrane depends upon the endothelium for regeneration, and for this reason damage to the endothelium should be avoided in intra-ocular surgery. Cell sliding or cell migration, in response to inflammatory stimuli, is another method by which superficial damage to the canine cornea may be obliterated, sometimes overnight.

The instillation of an acid onto the cornea results in the formation of a precipitate barrier which limits penetration. In the case of an alkali, no such precipitate is formed and penetration is deeper. It may do irreparable damage. Hence, the importance of soap burn in a dog's eyes.

Neosynephrine (10%) is a very quick acting mydriatic. It is useful for ocular examinations and for breaking down adhesions of the iris.

To differentiate conjunctival (superficial) and ciliary (deep) inflammatory processes, a good rule of thumb is:

1. Conjunctivitis is likely if there is a mucopurulent secretion and the lids stick together.

2. Iritis is likely if the secretion is watery, eye painful and pupil small.

3. Glaucoma is likely if the secretion is watery, eye painful and pupil dilated.

Since spasm of the ciliary body is an important source of pain in inflammatory eye disease, an agent which is capable of paralyzing the ciliary body is a useful and dramatic pain reliever. Atropine is just such an agent. It may be used in concentrations from 1% to 4%, but 2% is most commonly employed. The only contraindication for the use of atropine in ophthalmology is glaucoma.

A good eyewash formula is as follows:

Sodium bicarbonate	½ oz.
Borax	½ oz.
Sodium chloride	½ oz.
Glycerine	2 oz.
Roccal (1:10,000) qs	1 gal.

Add qs. Pontocaine to make .25%.

Castor oil is very soothing to the eyes. Its use is recommended prophylactically before bathing dogs, and it is quite beneficial after cautery.

A very important reason for the persistence of infection in cases of purulent conjunctivitis or keratoconjunctivitis is that the infection is commonly subepithelial (subconjunctival). In order to expose the organism to local antibiotics, it is often necessary to actually slough off the entire bulbar and palpebral conjunctiva. Under general anesthesia, the entire membrane is rubbed with a small crystal of copper sulfate. The

procedure is best done with the aid of a 5 power binocular loop. The crystal is held in small tissue forceps. All surfaces are carefully coated, and the entire area washed thoroughly with saline.

An astringent eyewash to stimulate activity in chronic conjunctivitis or to reduce excessive tearing in white Poodles is:

Zinc sulfate ..... 32 grains
Boric acid .....160 grains
Distilled water or Roccal.....1 qt. (qs)
Sig: Two drops each eye, *b.i.d.*

The drugs of choice in cauterization of corneal ulcers are tincture of iodine and pure phenol (when more tissue destruction is desirable).

Antibiotics: The penetrating ability is an important criterion for use.

Local: Penetration of intact corneas. Chloromycetin, very well. Sulfas, fairly well. All others, poorly, if at all. Penetration of abraided corneas: All penetrate well.

Systemic: Sulfas reach the intra-ocular fluid quite well, but Chloromycetin diffuses into it best of all. It is quite effective when given orally. All other antibiotics must be given in massive doses to get any across the blood aqueous barrier.

It is best to do antibiotic sensitivity testing in all cases of infection involving the eye. However, Chloromycetin drops, ointment and/or systemically is most often the drug of choice.

Steroids: In acute conjunctivitis or corneal disease, wait 24 to 48 hours, then use only steroids with an antibiotic. The subconjunctival injection of 2.5 mg. to 5 mg. of prednisone every 2 to 3 days is faster. The action is more uniform and prolonged than with the drops or ointment.

Ten mg. to 15 mg. of riboflavin daily is indicated in all cases of superficial vascularization.

For local anesthesia 1% pontocaine or ophthaine are best. One c.c. of a 2% to 4% solution procaine injected retrobulbarly is recommended for further relaxation during general anesthesia.

Practical notes from Dr. Magrane's short course as reported by R. Knowles, D.V.M.

Fla. Vet. Bull.
December, 1960

Tinting Pets

With Easter approaching, veterinarians may receive requests from clients for information about the tinting or dyeing of chicks, ducklings and rabbits. Some states and individual areas have laws regulating this practice. The December 1960 issue of *All Pets* magazine lists the following states which have such laws: Alabama, Illinois, Massachusetts, Michigan, New Jersey, New York and Rhode Island. In addition, many cities also have comparable legal restrictions relating to animal dyeing and their sale.

R. R. Dykstra

Round Cell Sarcoma In a Dog

A 5-year-old male pointer was brought to the hospital for an autopsy. According to the owner, the dog had been worked the day before. He had worked well, in a normal vigorous manner and ate his feed with no evidence of illness that night. The dog was found dead in his pen the next morning, and was immediately brought to the hospital.

On necropsy the thoracic cavity was filled with free blood. A hole about the size of a pencil was found in the diaphragmatic lobe of the left lung. The diaphragm was intact and no break appeared in the skin or musculature over the rib cage. Trauma did not appear to be the cause of the lung lesion. No other gross lesions were observable although a careful examination was made.

Sections of the affected lobe of the lung

and other organs were submitted to the Clemson Diagnostic Laboratory for cultural and histopathological studies. A round cell sarcoma was found affecting the lung. Apparently the sarcoma had eroded a blood vessel and the resultant hemorrhage had caused death.

Round cell sarcomas are derived from the mesoderm. They are anaplastic and have not reached a difinite stage of differentiation. In later stages of their development they become differentiated into various types.

Bruce G. Pratt, D.V.M.
The South Carolina Veterinarian
Vol. 2, No. 2, Winter, 1961

Equine Lameness Review

Bone Spavin

An exostosis on the medial surface of the hock at the junction of the distal row of tarsal bones and the metatarsal.

Etiology: Not known definitely, probably it is due to injury and over training.

Symptoms: The lameness is quite suggestive. At first the animal will warm out of the lameness. The periostitis is intermittent at first but becomes more constant. The animal then drags the toe because it will not flex the hock.

Diagnosis: The Spavin Test. Hold the affected leg in extreme flexion for 30 to 60 seconds, then start the animal out suddenly. The first few steps will show a marked lameness. When exostosis appears with the lameness, it is a positive diagnosis.

Prognosis: Guarded, about 50% will recover from lameness.

Treatment: Fire into the exostosis.

Bog Spavin

A distention of the joint capsule that protrudes on the anterior-medial surface of the hock.

Etiology: Not known.

Symptoms: A distention of the joint capsule that will move. The animal is rarely lame.

Prognosis: Guarded, it is blemish.

Treatment: Aspiration of the joint fluid and injection of cortisone and antibiotics. If repeated 2 to 3 times, this will aid about 50% of the early cases. Put a young animal on a mineral supplement.

Stringhalt

The leg is jerked up with excessive flexion.

Etiology: The cause is unknown but probably is a disturbance in the nerve innervation.

Symptoms: The leg is jerked up with excessive flexion. This often is done only when the animal is first moved.

Prognosis: Guarded, as only a few will grow out of it.

Treatment: Severance of the lateral extensor of the digits is a standard treatment. About 1 inch of the tendon is removed.

Idiopathic mandibular paralysis is a bilateral motor paralysis or may be a partial bulbar paralysis commonly found in large hunting dogs. The animal is slightly depressed and unable to grasp food. Recovery follows in 1 to 4 weeks. Photo courtesy of J. Mosier, D.V.M., K.S.U.

Clinical Use of Organic Phosphates To Control Canine Demodicidosis

J. K. McGREGOR, M. Sc., D.V.M.
L. H. LORD, M.S., D.V.M.
Ontario Veterinary College
Guelph, Ontario, Canada

This study was conducted to further evaluate the use of organic phosphate insecticides in the control of demodectic mange.

In their clinical report, McGregor and Lord[1] outlined methods of using *0,0*-dimethyl *0*-2,4,5-trichlorophenyl phosphorothioate (ET 57—Dow) to control clinical demodicidosis in dogs. The sample of cases treated was small and the results observed, while encouraging, were not conclusive. To further test the value of their observations, additional clinical trials were conducted using the more successful of the methods reported previously. In addition other chemical agents, that potentially might be effective antidemodex agents, were tested.

Materials and Methods

Thirty-seven dogs, eight weeks to one-and-a-half years old, were treated during these experiments. Thirty-four dogs received for treatment were referred cases and three dogs were acquired locally for these experiments. No dog was undernourished, four dogs showed evidence of parasitism and three were in the incubative stages of distemper when received. Clinically the cases treated ranged from the mild one-spot type to extreme cases where most of the skin was involved and pus accumulations under the skin much in evidence.

Diagnosis of the cases treated was made initially by examination of skin scrapings. During treatment the dogs were housed indoors at all times. Prior to treatment the dogs to be treated were first bathed with an antiseptic detergent cleansing agent and then given antidistemper serum. The hair coat over the affected areas of the body was clipped and the integument adjacent to those areas exposed.

Four therapeutic agents were used to treat the dogs during these experiments. Three of these were systemic insecticides. They were ET-57 (Dow), Ruelene (Dow) and Co-Ral (Chemagro). The other agent was bismuth triglycollamate (Oribis, Pitman-Moore).

Dow ET 57 was used in two ways. In instances where the demodex infection was incipient and only a few local lesions were apparent, a topical application of a 25% emulsion of ET 57 in equal parts of glycerine was applied locally to the lesions

daily. Where an advanced demodex infection or a fulminating condition was encountered ET 57 emulsion was applied topically to one-third of the body each day and capsules of the granular form of the chemical were given orally at 110 mg. per kg. of body weight once a week for as long as was deemed necessary. Where a treatment using any of the other agents mentioned above failed to resolve the clinical manifestations of demodicidosis within a period of two weeks the dogs were bathed and another treatment often was substituted. Twenty-eight of the dogs treated received ET 57 during the trial period.

Ruelene was administered in a combined topical and internal treatment to eight dogs. An emulsifiable liquid formulation containing 48.4% of the active agent was diluted to 24.2% with glycerine for the topical applications. Internal medication was given orally in the form of granular Ruelene administered at 30 mg. of the active agent per kg. of body weight once a week for three weeks unless the treated dog was obviously not improving or the condition was spreading while being treated.

Co-ral was applied in the form of a bath in which the dog was dipped into an aqueous suspension of the chemical. Two concentrations of Co-ral were used during these experiments. In the first instance a 0.35% aqueous suspension of Co-ral in sufficient amount to dip the treated animals was used. Because of unsatisfactory results achieved with the 0.35% concentration the strength of the active agent was increased to a 0.5% solution. Two baths were given to each dog two to three weeks apart provided the dog could withstand the effect of two baths. During each bath the dog's coat was thoroughly saturated, after which the dog was allowed to drain and then patted with a towel to remove the excess material in the coat. Seven dogs were treated with Co-ral.

Oribis in 410 mg. tablets per 20 lb. of body weight were given in a recommended schedule of three doses of the chemical a day for four days, then two doses a day for four days followed by one dose a day for 14 days. Seven dogs were treated with Oribis.

Any dog suffering from a pyogenic skin infection in combination with demodicidosis was treated with a streptomycin/penicillin preparation prior to the use of the strictly

Demodectic mange in an English Bulldog. (Photo by J. Mosier, D.V.M., Kansas State University).

antidemodex chemicals to control the mange condition.

Observations and Discussion

Seventeen dogs were treated with Dow ET 57 alone, and the other 11 were given ET 57 at some period during the course of treatment — usually to resolve a demodex case that would not respond to other medication. Twenty dogs received combined internal and external applications of ET 57. The other eight dogs in the group were treated topically with this chemical in glycerine. The results of the purely topical application were satisfactory provided the lesions were minimal and discrete. The lesions cleared up within two weeks in these particular cases. When the combined internal/external treatment was given, all of the clinical cases responded, but they did not do so uniformly. In three cases the active skin condition present subsided after a week of treatment. Four dogs had recovered enough after two weeks of treatment to be discharged. Nine dogs required three weeks treatment and two others were quite stubborn in that five and six weeks of the combined treatment were needed to produce a clinical cure.

Unfavorable reactions were observed in two cases. A four-month-old Airedale under treatment for 13 days showed considerable improvement in the skin condition using the combined ET 57 treatment, but by the 15th day the skin lesions had broken down and numerous subcutaneous hemorrhagic spots about ½ cm. in diameter were observed. These spots frequently coalesced, particularly in the axillae, groins and face. A bloody, serous exudate emanated from several points on the skin and the dog was in considerable pain. The mange treatment was suspended at once when this new condition became evident. A disinfectant (Phisohex—Winthrop) was applied to the skin followed by topical steroid treatment (Prednisolone). The hemorrhagic condition receded but within two weeks the dog showed classical signs of distemper and was destroyed.

The second case involved a nine-week-old Dachshund given the internal/external ET 57 treatment. At first the dog responded well to treatment but reacted unfavorably to the second application of medication. A day after the second internal medication was given the dog showed profound signs of depression, hematemesis and diarrhea with melena. Except for the administration of blood transfusions and intravenous dextrose the dog would likely have died. The syndrome presented was ascribed to a sensitivity of the dog to the drug applied. Possibly the age of the dog influenced the response to treatment.

In six cases ET 57 internal/external treatment was used successfully to resolve active demodicidosis that had been treated experimentally with one or more of the other chemical agents used in these trials but which had not reacted satisfactorily. In two cases treatment commenced with ET 57 but because the skin condition did not show evident response to this form of treatment other agents (Oribis, Ruelene) were substituted to attain clinical cures.

Ruelene applied after the manner of ET 57 except for the concentration, was not considered to be an outstandingly effective agent against canine demodicidosis under the conditions of these experiments. Of the eight dogs treated with Ruelene one responded well to medication. This was an early fulminating generalized case of the disease. Another case was resolved in three weeks but the action of the chemical was not impressive, since the lesions abated slowly as though uninfluenced by external forces. In yet another instance a dog, treated previously with ET 57 to which it had not responded satisfactorily, was given internal/external therapy using Ruelene for 24 days. At the end of this period the skin condition had cleared up and the dog was discharged. Ruelene was not toxic in any apparent way when used in the concentrations mentioned above.

Co-ral was used to treat seven dogs. In

all but one case the lesions failed to respond to the effect of the baths that were given. Three of the dogs given two baths each were unaffected in any visible way by the agent used, whereas the other four dogs showed a variable reaction to Co-ral ranging from a mild subduing effect to severe depression, inappetance and diarrhea. In one instance the disease resolved after one treatment in a 0.5% Co-ral bath, but the reaction of the dog to treatment was quite marked in that severe depression, inappetance and diarrhea were evident. Live mites were isolated in skin scrapings taken from five treated dogs within ten days after the treatments were concluded.

Two dogs responded to treatment with Oribis among seven that received this form of medication. In all other cases the metallic salt had the effect of improving the health of the skin and the hair coat markedly. Some of the lesions regressed but other new lesions were observed to occur during the course of treatment. Live mites were observed in skin scrapings taken post-treatment. Increasing the dosage to approximately double that recommended did not noticeably improve the action of Oribis in selected cases.

Conclusions

Of three organophosphate compounds only *0,0*-dimethyl *0*-2,4,5-trichlorophenyl phosphorothioate (ET 57) used in combined internal/external treatment and as a topical application showed considerable therapeutic effect on the course of canine demodicidosis. However, the use of the chemical even at apparently safe levels may have some adverse effect in individual cases, especially in very young dogs. Bismuth triglycollamate had an improving effect on the health of the skin and hair coat but only exhibited a limited therapeutic action on demodicidosis under the conditions of these experiments.

REFERENCE

1. McGregor, J. K. and Lord, L. H., Clinical Report —Control of Demodectic Mange. *Vet. Med.*, 54(6): 308-310 and 312, 1959.

Angina Pectoris in a Dog

On August 10, 1960, there was presented an 11-year-old black male Cocker with a history of chronic pain in the left front leg. This condition would hit the dog suddenly, with the dog raising the leg, refusing to move and crying out as if in severe pain. This would happen sometimes once, sometimes several times daily, then have intervals of days, even weeks, without pain. Then there would be an occasional flare-up, followed by several days of no symptoms, and then more seizures of severe pain. The condition had been diagnosed as chronic arthritis in the elbow joint.

When presented, the dog would walk very haltingly and carried the left front leg. Upon examination any pressure in the left pectoral region would cause loud cries, and opening the mouth would almost cause a convulsion. The owner advised that the seizures were averaging five or six a day.

From history and symptoms a diagnosis of *angina pectoris* was made, and the owner was advised that the prognosis was poor. The dog was placed on 4 Rutol tablets (Pitman-Moore) daily for 10 days, then 2 daily for 10 days, and then 1 tablet daily. Rutol has phenobarbital for slight sedation and mannitol hexanitrate and rutin for long-lasting vaso-dilator effect. Symptoms subsided within 24 hours, and to date (30 days) none have recurred. The owner advises that the dog seems to feel better than he has in several years.

Editor's Note: *Angina pectoris* is described in "Stedman's Medical Dictionary" as, "severe constricting pain in the chest, radiating from the region of the heart to the left shoulder and down the arm, accompanied by cardiac oppression and sometimes the apprehension of immediate death, due to ischemia of the heart muscle, usually caused by coronary disease."

Earl A. McDowell, D.V.M.
The South Carolina Veterinarian
Vol. 2, No. 1, Winter, 1961

Medical Interchange

Notes and abstracts screened from the medical literature for their special interest to veterinarians by Lynn Stratton Morris.

Radiographic Diagnosis of Tapeworm

Barium studies done on a dog at the Radiology Department, Mount Sinai Hospital, New York, disclosed long, uniform, sharply outlined, linear defects about 2 mm. in width.

Drs. Charles M. Newman and Bernard S. Aron suggested that these defects represented a tapeworm. At necropsy a tapeworm (*Taenia saginata*?) 6 feet in length was found in the small bowel. The appearance was similar to that found in a 20-year-old human patient and indicated that the diagnosis of tapeworm infection roentgenologically was possible.

Previous efforts to rid the boy of the tapeworm had been unsuccessful. On this occasion, however, following atabrine and a saline purge, a tapeworm approximately 20 feet long was passed per rectum. The parasite was identified as *Taenia saginata*.

The recognition of the presence of a tapeworm in the intestinal tract on roentgen examination is rare, the radiologists reported. Since the worm is quite flat, measuring about 1 or 2 cm. in width and 2 or 3 mm. in thickness, only the portions of the worm seen in profile could be recognized. A variety of appearances could occur as a result of the variations in the plane of projection of the worm as compared with the direction of the *x*-ray beam. This would explain the apparent discontinuities in the linear filling defect. Irregular rounded defects due to coiling up of a portion of the worm or of a chain of segments also have been described.

In contrast to the findings in the round worm (*Ascaris*), no barium will be visualized in the intestinal tract of the tapeworm since the intestinal tract is confined to each segment, does not traverse the entire length of the worm, and the intestinal pore is extremely small.

Jour. Mount Sinai Hospital, 28:91-93, January-February, 1961

Role of Colostrum

That infant mammals need their mother's milk is well known, but the "why" is only now being investigated.

A beginning was reported recently at The New York Academy of Science's conference on plasma proteins held in New York City. The report dealt with piglets and the differences induced in their serum proteins by modifying their diets—feeding them cow colostrum or cow's milk fortified with eggs in lieu of sow colostrum. The studies, conducted over 3 years at North Carolina State College, were presented by Dr. J. G. Lecce.

Baby pigs on the experimental diets, which included cow's milk, simulated cow's milk, amino acids, short-chained peptides,

vitamins and minerals, were slower to develop mature serum protein profiles (determined by regular blood tests beginning with the first day of life) than a control group of suckling piglets. They tended to develop diarrhea and many died.

Piglets that suckled developed mature serum protein profiles within 14 days. Those on cow's milk required 4 to 7 days longer and those on artificial cow's milk even longer, while those on the amino-acid diet showed no change.

Further research established that proteins of the colostrum pass directly through the intestinal wall and into the piglet's blood stream, building the antibody defenses of the young animal against disease and providing other plasma proteins which play a role in the development of the mature serum protein profile.

Dr. Lecce observed that the serum protein fractions of the mature profile are synthesized by the piglet, but only slowly if the diet has not included the mother's colostrum. What part these fractions may play in disease resistance is yet to be discovered.

Thrombocytopenic Purpura

The occurrence of thrombocytopenic purpra in a 9-year-old boy, 1 of 3 brothers affected by cat-scratch disease, is described by Drs. Otto E. Billo and James A. Wolff of Babies Hospital, New York City. All 3 boys had been continuously exposed to 11 farm cats during their summer vacation.

Thrombocytopenic purpura developed at the end of the 4th week; bleeding manifestations were mild. Spontaneous return of the platelet level to normal preceded subsidence of the basic infection in this case. The platelet depression was judged to be a true complication of the underlying infection rather than coincidental or secondary to antibiotic therapy.

Instances of central nervous system involvement in cat-scratch disease have been frequent and there also have been reports of an associated erythema nodosum. Only 1 previous report in the medical literature has implicated cat-scratch disease in the pathogenesis of thrombocytopenic purpura. This case concerned a 26-year-old man in whom thrombocytopenia with hemorrhagic manifestations developed 5 weeks after the onset of cat-scratch disease. The patient was splenectomized with return of normal platelet count within 2 weeks.

Jour. Am. Med. Assn., 174:1824-1826 (Dec. 3) 1960

Pre-Exposure Rabies Vaccine

The development of pre-exposure human rabies vaccine is an encouraging advance in the control of rabies among those frequently exposed to animal bites.

Many veterinarians in Arkansas now are making use of this service. In 1959, some 14 veterinarians were exposed to positive rabid animals. Many of these had received the pre-exposure vaccine and had only to take 2 booster injections intracutaneously of .2 ml. of vaccine in order to build a high antibody protection level against rabies. Those less fortunate had to take the tissue vaccine of 14 doses.

The primary course of the vaccine now consists of 4 intracutaneous injections of .2 ml. at intervals of approximately 5 to 7 days. If a person ever has had the Pasteur treatment for rabies, only 1 injection is required, usually .2 ml. of vaccine, to build up protective antibodies against rabies. The vaccine is reported to confer a high degree of active immunity against rabies for a period of 2 years and probably longer. There have been no systemic post-vaccinal reactions, although in some instances a moderate local reaction has been reported at the injection site following the 2nd injection.

To determine the level of antibody protection, blood samples are necessary. One specimen is collected before vaccination and one approximately 1 month after the last injection. These are submitted to the State

Board of Health hygienic laboratory where they are paired and sent to another laboratory specializing in this type of determination. In a few cases individuals have received 6 or 8 injections before acquiring a satisfactory antibody level against rabies.

The program is purely voluntary and must be requested from the State Health Department by the interested person.

Jour. Ark. Med. Soc., 57:329, January, 1961

Overuse of Muscles

In human beings, horses, dogs and possibly in other animals, overuse of unconditioned large muscle groups may lead not only to aches, stiffness and discomfort but also to actual swelling and tenderness and in the case of horses, irreversible changes.

Dr. John H. Arnett of Drexel Institute of Technology and Dr. Kenneth D. Gardner, Jr., of the University of Pennsylvania School of Medicine, Philadelphia, studied the effect of muscular exertion on urinary abnormalities.

In both humans and horses overuse of powerful muscles may result in proteinuria, cylindruria, hemoglobinuria, myoglobinuria, and hematuria, especially following periods of muscular inactivity.

Abnormalities were found in a young fraternity initiate following hazing. Blood studies showed that erythrocytes were absent from his urine and hemoglobin from his serum. They concluded that his hemoglobinuria was the result of red cell hemolysis within the urinary tract. Complete recovery apparently ensued within 5 days.

From a review of the literature the investigators have been unable to find any recorded fatalities associated with the hemoglobinuria or myoglobinuria of athletes, but fatal paralytic myohemoglobinuria has been reported in man. In horses suffering from hemoglobinuric or myoglobinuric paralysis, a mortality rate of between 20 and 70% is reported.

Am. Jour. Med. Sci., 241:55-58 January, 1961

Coliform Counts in Private Wells

Season of the year is a major factor controlling bacterial content of well waters, according to a study of over a year of 2 private-home wells.

Further analyses of water in 2,417 private wells collected from 1940-1950 throughout the state of New Jersey corroborated the finding, R. A. Voelker, chairman, Department of Engineering, Antioch College; H. Heukelekian, chairman, and H. E. Orford, professor, Department of Sanitation, Rutgers University, New Brunswick, N. J., have reported.

Bacterial count (most probable numbers) values for coliforms, ranging from 0 to 90,000 per ml. or more, followed basically a regular trend. High counts were typical of the warmer months (August and September were the poorest quality), with counts decreasing through the fall to minimum values (as low as zero) about January, followed by a steady climb through the spring.

Throughout the study the dug-well type was found to exhibit higher variability (from 0 to 180,000 per 100 ml.) than the drilled-well type (from 0 to 90,000 per 100 ml.).

Apparently, there is a direct relationship of bacterial numbers to air temperature. By seasons a total range of 40 percentage points difference in coliform-free wells was found, but from year to year there were no statistically significant variations in average yearly bacterial quality.

There is some evidence that the effect of rainfall on well-water levels in the wells is related to the number of coliforms in the well. Evidence to support the theory that percolation of rain will cause an influx of surface bacterial contamination also was found, but the data gave no support to the theory that rainfall can improve bacterial quality by a dilution effect.

Am. Jour. Pub. Hlth., 50:1873-1881, December, 1960

Encephalomyocarditis Virus Infection of Swine

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This report describes the first cases of encephalomyocarditis (EMC) virus infection in swine in North America. A previous case of the disease in swine has been reported from Panama.[1] Otherwise, the virus has been recovered only from rodents, primates and man.[3] In man most infections have been of a mild nature. The virus has been classified in the enterovirus group.[2]

History and Signs: Two groups of pigs were affected. One group of unweaned animals, 6 weeks old, suddenly became sick and had high fever. Thirty out of 80 died. Deaths occurred a few hours after the first symptoms were noticed. These animals were in good general condition. Pig pox was present in varying degrees of severity. These pigs were not vaccinated against hog cholera, but were nursing vaccinated mothers. The other group consisted of 5 animals weighing about 100 lb. They were not vaccinated for hog cholera, and they were from a farm 50 miles from the first case. These older animals suddenly became sick, exhibiting emesis, weakness and diarrhea. Four out of 5 animals died. One animal treated symptomatically recovered. Elemental phosphorus was detected in stomach contents of 2 animals, which complicated the syndrome. Presumably, they had eaten a phosphorus rodenticide or rats poisoned by phosphorus. However, phosphorus was not detected in the livers and kidneys of these animals.

Clinical Findings: Two of the younger animals were alive upon arrival at the laboratory. Their leucocyte counts were 3,500 and 3,800; their differential counts were 56% lymphocytes, 41% neutrophils, 3% myelocytes, and 62% lymphocytes, 37% neutrophils and 1% monocytes, respectively. Packed cell volumes were normal.

Gross and Microscopic Findings: The gross lesions in both groups of swine were confined to the heart. They appeared as discrete, white foci, measuring 1 mm. by 2 mm. to 8 mm. by 10 mm., which were located just beneath the epicardium and extended into the myocardium of the right ventricle. The arrow in Fig. 1 illustrates one such lesion. The number of lesions per

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Dr. J. H. Gainer is veterinary virologist, Dr. T. E. Murchison, veterinary pathologist. The younger group of pigs was submitted by Dr. J. D. Watson, Jr., Trenton, Fla.; the older group by Dr. J. D. Martin, Live Oak, Fla.

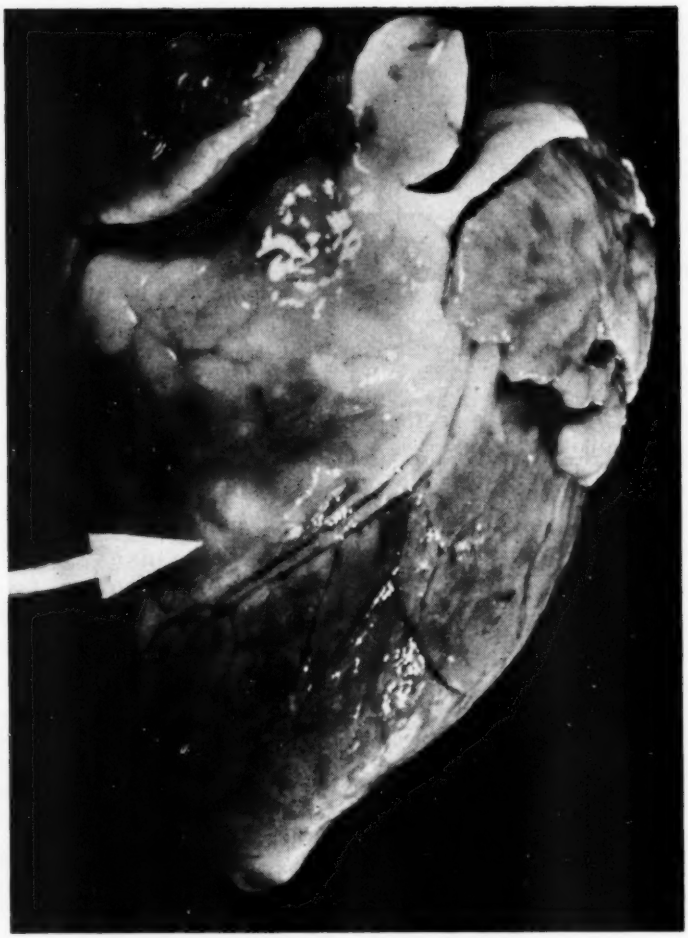

Fig. 1. A typical myocardial lesion of encephalomyocarditis is shown at the point of the arrow. Lesions are discrete, white foci, varying in size from 1 mm. by 2 mm. to 8 mm. by 10 mm.

heart varied from 1 to 20. Three pigs in the younger group and 2 in the older group were examined. All 5 animals had myocardial lesions. Microscopically, these focal lesions were found to consist of necrosis, calcification and monocytic infiltration.

The spleens of the younger pigs were about ½ normal size. Their kidneys had many subcapsular petechial hemorrhages. The older pigs had a sero-fibrinous pleuritis and peritonitis and hydropericardium. Livers from both groups were extensively scarred, probably the result of parasite larvae migration.

Bacteriological and Virological Studies: The EMC virus was recovered and specifically identified from the tissues of the 2 groups of swine. It was also recovered

from rat feces and sow feces, but not from pig feces of the younger group collected on the farm 6 weeks following the initial outbreak. Livers, spleens and intestinal contents examined bacteriologically failed to reveal the presence of any of the common bacterial pathogens. Inoculation of various swine tissue suspensions (spleen, heart, lungs and brain) into mice produced a perivascular, lymphocytic encephalitis and myocarditis characteristic of EMC infection. Subsequent passage of mouse brain and spinal cord suspensions revealed an agent readily infective for mice. Neutralization of this agent by specific immune rabbit serum against the EMC virus resulted in greater than 10^4 logs of protection. Normal rabbit serum had no such neutralizing effect.

Serum collected from 1 of the surviving pigs of the younger group 6 weeks after the initial outbreak revealed greater than 10^3 logs of protection against the original virus isolate. Neutralization tests on serums of 2 laboratory workers failed to reveal the presence of any antibodies against the EMC virus. These workers had been handling the virus for 2 months at the time of the collection of their serums.

Discussion: This is the first report of the isolation in North America of the encephalomyocarditis virus and description of the disease in pigs. Dr. J. D. Watson, Jr., who submitted the first case, feels certain he has seen the same condition for 2 to 3 years and had considered the lesions of bacterial origin. In view of previous isolations made from man, the presence of this virus can be cause of distinct public health concern. No serums have been checked for EMC antibodies from human beings on the premises where the swine were infected. Two people working with the virus in the laboratory for 2 months failed to reveal any neutralizing antibodies in their serums. Nevertheless, infection of man is a possibility and further studies along these lines will be pursued.

The source of infection in both groups of swine is postulated as being infected rat excreta which was ingested by the swine. Many rats were present on the premises. Rat feces were found to contain the virus. The fact that the virus was also recovered from the sow feces suggests that the sows may act as carriers.

The leucopenia present in the 2 live pigs submitted for necropsy examination and the presence of petechiae on the kidney would make one consider simultaneous infection with the hog cholera virus. Differentiation from hog cholera was made on the basis of histopathologic examination of the swine brains.

Summary

Isolation of the encephalomyocarditis virus from swine on 2 farms in Florida and the description of the disease is reported for the first time in North America. The characteristic gross lesions seen in the acute disease are discrete, white, focal discolorations of the myocardium of the right ventricle. This lesion, microscopically, is necrosis with calcification and monocytic infiltration.

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The authors thank Dr. J. W. Needham, Florida Department of Agriculture, Kissimmee, for the phosphorus analysis, Dr. E. M. Ellis, Florida Department of Agriculture, Kissimmee, for the hematologic and bacteriologic studies and Dr. C. J. Gibbs, Jr., NIAID, NIH, Bethesda, Md., and Dr. W. L. Pond, Chief, LTV, OD, NIAID, Jackson Memorial Hospital, Miami, Fla., for supplying the EMC immune serum.

Micro and Wintrobe Hematocrit Determination upon Bovine Blood

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A comparison between Wintrobe and Microhematocrit upon bovine blood shows that the differences are within the standard error of these two methods. This work was done in the Department of Applied Medical Sciences, School of Veterinary Medicine, University of Pennsylvania.

The measurement of packed cell volume or hematocrit is a routine procedure in the laboratory examination of blood. The Wintrobe[1] method has long been the universally accepted method for hematocrit determination. Strumia[2] in 1954 described a method of microhematocrit determination which has become popular due to its speed and accuracy. The microhematocrit has been standardized for the canine,[3] and useful estimations of hemoglobin and red blood cell count can be made from the

packed cell volume.

The purpose of this communication is to report a comparison between the Wintrobe and microhematocrit on bovine blood.

Materials and Methods: Blood was collected from 44 adult Holstein and Guernsey cows. Heparin was used as the anticoagulant. Each sample was redivided into 3 separate tubes, and each tube was examined in the laboratory as an unknown.

The microhematocrits were done on an International Micro Capillary Centrifuge, model MB and read on an International Micro Capillary Tube Reader, model CR. Wintrobe hematocrits were done by the usual method.[2]

Results: The result of the comparison between Wintrobe and microhematocrit on bovine blood are shown in Table 1. These samples represent 44 apparently normal cows and 132 separate determinations. Each set of 3 determinations from the same animal was averaged. The average deviation on all triplicates was ±.3%. Microhematocrit reading averages were 34.5%, 4.3% ±1.29 lower than the 38.8% obtained using the Wintrobe method. Microhematocrits ranged from 29.0 to 43.0%. Wintrobe hematocrits ranged from 34.0 to 50.0%.

Using the factor 0.94[4] for the correction of the amount of trapped plasma in the Wintrobe hematocrit, the corrected mean of the readings was 36.5%. This was 2.0%±1.0% higher than the microhematocrit, which is within the standard error of the differences between Wintrobe and micro method.

Discussion: The microhematocrit gives a simple, rapid accurate method of determining the hematocrit of bovine blood. It also gives a value which can be assumed close to the true hematocrit when you correct the Wintrobe readings.

TABLE 1

Comparison of Microhematocrit with Wintrobe Hematocrit on Bovine Blood

Wintrobe Percent	Wintrobe Corrected	Micro Percent
35.0	32.9	33.0
35.5	33.4	32.0
37.0	34.8	30.0
37.5	35.3	31.0
44.0	41.4	39.5
43.0	40.4	38.5
38.0	35.7	33.5
38.0	35.7	33.0
50.0	47.0	43.0
48.5	45.6	42.0
35.5	33.4	31.0
35.0	32.9	31.5
39.0	36.7	36.0
39.5	37.1	34.5
39.2	36.8	35.0
37.5	35.3	32.5
42.5	40.0	39.0
40.0	37.6	36.0
44.0	41.4	40.0
42.5	40.0	38.5
39.0	36.7	35.0
39.0	36.7	35.0
41.0	38.5	38.0
43.0	40.4	37.5
38.0	35.7	34.0
37.0	34.8	34.0
34.0	32.0	30.5
34.0	32.0	30.5
39.0	36.7	35.5
37.0	34.8	33.0
34.0	32.0	29.5
34.5	32.4	29.0
35.0	32.9	32.0
30.0	28.2	28.0
35.0	32.9	32.0
34.0	32.0	30.5
38.0	35.7	35.0
34.0	32.0	30.0
43.0	40.4	36.5
41.5	39.0	36.0
41.0	38.5	36.2
40.0	37.6	36.0
45.0	42.3	37.5
39.0	36.7	35.7
Average 38.8	36.5	34.5

Difference between Wintrobe and Microhematocrit	4.26% ±1.29%
Difference between Corrected Wintrobe and Microhematocrit	2.00% ±1.09%

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Tylosin, an Effective Antibiotic For Treatment of PPLO Turkey Sinusitis

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A field strain of PPLO isolated from the affected turkeys was found to be sensitive to low concentrations of Tylosin but resistant to high concentrations of streptomycin.

In October of 1959, a flock of 7,500 bronze turkeys were examined for the presence of pathogenic PPLO. The flock, consisting of toms and hens about 18 weeks of age, had exhibited sinusitis during the previous 4 weeks. Coughing was a prominent symptom. About 200 of the most severely affected turkeys had been treated with streptomycin, and later 100 of them were treated with oxytetracycline and the other 100 with erythromycin. Essentially no clinical response was noted following the use of these 3 antibiotics administered into each sinus and intramuscularly.

Blood samples and specimens of sinus exudate were collected from several nontreated turkeys. The blood serum samples revealed PPLO HI titers of 1:160 or greater to the pathogenic serotype. PPLO were readily isolated from sinus exudate inoculated into turkey meat infusion broth containing 20% turkey serum and 3% yeast autolysate, with penicillin and thallium acetate as inhibitors. The isolated PPLO proved to be pathogenic when inoculated into the sinuses of normal turkeys.

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Tylosin (Eli Lilly and Company, Corn States Laboratories, Inc.) was reported to be of value against PPLO infections by Barnes *et al.*[1] Arrangements were made to conduct experimental trials employing this recently developed antibiotic.

Three pens were fenced off on the alfalfa range area to facilitate a pilot trial employing Tylosin. Only birds which had not received previous treatment were selected. All of the 450 turkeys employed exhibited obvious sinusitis, either unilateral or bilateral, and coughing was prevalent. Two birds from each of the 3 groups selected were examined and cultured before treatment was initiated. Three exhibited bilateral sinusitis, 3 had unilateral sinusitis, 4 had tracheitis, and 4 had caseous air sac lesions. PPLO were isolated from all of the sinus and air sac exudates.

Tylosin tartrate solution for sinus inoculation was prepared to contain 10 mg. Tylosin activity per ml. with sterile distilled water. The Tylosin for intramuscular injection was prepared to contain 130 mg./ml. All of the treated turkeys received inoculation of both sinuses, and an intramuscular dose in the breast region.

The 150 turkeys in Group I received 10 mg. Tylosin activity per sinus, and 130

mg. I. M. The 169 turkeys in Group II received 5 mg. per sinus, and 130 mg. I. M. Group III consisted of 131 untreated, infected, control birds.

Clinical response was evident within the 1st week following treatment. All of the birds were individually handled at 2 weeks post-treatment. The following table presents the results recorded at the end of the 2nd week.

Clinical Response to Tylosin 2 Weeks Post-Treatment

Group	Treatment	Number Turkeys	Complete Clinical Recovery	Recovery Rate
I	Tylosin 10 mg./sinus 130 mg. I. M.	150	133	88%
II	Tylosin 5 mg./sinus 130 mg. I. M.	169	138	82%
III	None	131	17	13%

It is evident that the Tylosin therapy afforded an impressive clinical response even at the 5 mg./sinus level. Partial recovery was noted in several birds from each treated group, but these were not recorded as recovered individuals. The effect of Tylosin on the previously obvious coughing could not be evaluated since coughing had almost ceased in the entire flock during the 2 weeks of especially nice autumn weather encountered during the trial.

The remaining turkeys in the flock were individually inoculated with Tylosin tartrate. Every bird evidencing sinusitis was injected with 5 mg. Tylosin activity into each sinus. All of the turkeys received an intramuscular dose of 40 mg. Sinusitis was evident in approximately 3,000 (43%) of the 7,000 turkeys treated.

Two weeks later the hens were marketed. During the loading procedure the entire flock was observed, and an attempt was made to record the recovery rate of the hens handled. Approximately 8% still evidenced sinusitis, implying a recovery rate of approximately 81% of those previously affected.

The hens were followed through the dressing plant. Air sac lesions were not prevalent. No carcass was condemned for conditions likely to be related to PPLO infections. Forty-four hens were given special attention, since they represented 23 of the untreated infected controls and 21 hens treated with the 5 mg. Tylosin dose in the initial trial.

Sinusitis was evident in 17 (74%) of the 23 controls. Slight to moderate air sac lesions were present in six. PPLO were isolated from the 3 sinus exudate samples collected. Of the 21 treated hens, there was only 1 with sinusitis, and 2 with slight air sac lesions. PPLO were also isolated from this sinus exudate sample. There was no evidence of toxicity noted, and no blemishes were visible at the site of Tylosin injection into the breast.

The pathogenic PPLO culture, which was isolated from the original turkey sinus exudate samples, was tested for its sensitivity to Tylosin and streptomycin. Tubes of turkey meat infusion broth containing varying amounts of the antibiotics were inoculated with young cultures of the PPLO, and complete inhibition of growth was recorded after 48 hours of incubation at 37 C.

The culture was found to be completely inhibited by as little as 0.1 microgram of Tylosin per ml. of medium. However, over 20,000 micrograms of streptomycin per ml. was necessary to inhibit growth during the 48-hour test period. Thus, the *in vitro* tests substantiated the results of the field treatment.

Summary

A field trial was conducted to further evaluate the efficacy of Tylosin in the treatment of a laboratory confirmed case of PPLO infectious sinusitis in a flock of 7,500 bronze turkeys approaching market age.

Tylosin tartrate was administered at the rate of 5 mg. and 10 mg. activity per sinus in addition to 130 mg. I. M. Of the

150 birds receiving the 10 mg. sinus dose, 133 (88%) evidenced complete clinical recovery within 2 weeks. Of the 169 birds receiving the 5 mg. sinus dose 138 (82%) recovered. Seventeen (13%) of the 131 untreated controls recovered during the test period.

The remainder of the flock was treated with 5 mg. Tylosin activity per sinus and 40 mg. I. M. Approximately 3,000 (43%) of the 7,000 had some degree of sinusitis. The recovery rate was approximately 81% of those previously affected with sinusitis. No toxicity, or blemishes at the site of injection were evidenced.

The field strain of PPLO isolated was found to be sensitive to as little as 0.1 microgram of Tylosin per ml. of medium, but resistant to at least 20,000 micrograms of streptomycin per ml.

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Beef Bull Testing

Of the 6.5 million cattle artificially bred, 12 percent involve beef animals. The use of performance- and progeny-tested bulls, improved breeding efficiency and control of disease are the advantages established.

Several problems must be resolved before this method of reproduction can be used more extensively in a beef herd. Heat detection and handling facilities for cows differ from the methods which have been used with dairy cattle. The veterinarian in large animal practice is the best qualified individual to implement artificial insemination programs during the short seasonal breeding period of beef animals.

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Penicillin G In Milk and Blood

(continued from page 156)

tween the two. Penicillin in the blood and milk of untreated quarters persisted 12 to 60 hours (av. 32) and 24 to 60 hours (av. 33.5) respectively.

ACKNOWLEDGMENT

The authors wish to express appreciation to Constance Hyre, State Bacteriologist, for laboratory assistance in conducting the disc-assay analyses.

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Dairy Practice Pointers

Hip Sling

Discriminate use of the hip sling can play an important role in the management of milk fever. This is especially true in big 1,500 to 1,700 lb. cows that have the will to get up but just don't quite have strength to make it.

If the cow has no inclination to get up, the hip sling is of no value.

Photosensitization

Examination of the teeth of photosensitive cattle will reveal a purplish, pink or brown discoloration. A typical case will also have wine colored urine. This condition is caused by a recessive inheritance factor. On necropsy the bone marrow, particularly the cortex, will show a typical purple or brown color, but the color of the teeth is the clinching diagnostic lesion. The condition is commonly referred to as "pink tooth."

Displaced Abomasum

A nonsurgical effort can be attempted to relieve displaced abomasum. The theory behind this method is that the abomasum is trapped behind the heavy rumen and becomes distended with gas. Place the cow on her back and the weight of the rumen will carry it toward the backbone. At the same time the abomasum, lighter because of the trapped gas, is going to be carried toward the belly, which will be back to the sternal region where it belongs. The cow is then allowed to slowly turn over and regain her feet.

Abomasal Ulcers

Abomasal ulcers can cause 2 common clinical problems in the dairy cow. If a tiny ulcer perforates into the peritoneal cavity, the clinical picture is identical with hardware disease. If the ulcer is about the size of a fifty cent piece and ruptures, symptoms of diffuse peritonitis will be observed, followed by death in 1 to 5 days.

Cows can actually bleed to death internally from ulcers in the abomasum. Two types of symptoms may be observed. In one type the cow slowly becomes thinner over a period of time, and the owner reports having occasionally seen dark manure. We know that means there has been blood in the feces far up in the alimentary tract and probably in the abomasum.

The other type is an acutely sick animal. It looks toxic or dejected and resembles a cow down with milk fever. Some are actually down.

The difference is that the mucous membranes are very pale, and the heart is pounding at about 150 beats per minute.

Blood transfusions and anticoagulants are about the only therapy that is indicated.

Pulmonary Adenomatosis

A respiratory disease of cattle, known as pulmonary adenomatosis by Iowa investigators and proliferative pneumonia by Cornell workers, occurs during winter housing periods. Frequently, a night cough develops in about 80% of the animals.

Examination of these lungs has shown this to be identical to the human condition, silo filler's disease. Farmers have died by unknowingly inhaling fumes from the silo during a certain stage of fermentation.

This condition is prevented in cattle by spreading the silage out away from the animals before feeding. It is the steaming fumes observed during the winter that cause the trouble. It is often practical to put down the night feed in the morning, spread it out somewhere, and then put it in the bunks after it stands for a time. This will stop this coughing condition.

For the 2 or 3 animals in each herd that lose their long hair coat and go down in production, corticosteroids will bring about complete recovery.

Indiana State Meeting, 1961

Massaging the Rumen

An old form of treatment for handling impaction of the rumen, and less frequently for bloat, was massage. This was accomplished by slow boring with a closed fist into the region of the lower left flank for 10 minute periods, repeated at hourly intervals. Since this was physically tiring, an improvised method was to use a round fence post 6 to 8 feet long passed crosswise under the animal's abdomen.

A man grasping each end of the post and lifting on it slowly and methodically for a 10-minute period every hour served to massage the rumen.

It was customary to administer copious amounts of water via the stomach tube as a preliminary step for impaction or as an antizymotic for bloat.

Case Report: Superovulation in the Cow

On November 13, 1960, Dr. P. K. Dougan, Ankeny, Iowa was called to the Iowa State University Twin Heifer Research Farm to check a Holstein cow with an enlarged abdomen. The case was diagnosed as hydrops amnii. Three calves and 50 gal. of fluid were removed from her. On November 14, Dr. Dougan was called again and delivered 3 more calves from this cow. This 4-year-old cow had aborted 6 calves (total weight 171 lb.) at 7 months of pregnancy.

This particular cow had been a repeat breeder. Therefore, after the 4th service she was given 1,500 units of follicle stimulating hormone on the 18th day of her cycle. At the next service she settled. Apparently, she had superovulated. Two ova were shed on one ovary and 4 on the other.

This treatment has been used on many cows, but this is the first occurrence of superovulation of which I am aware.

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Importance Of Hand Washing

Almost all authors who write on the subject of aseptic technic stress the importance of proper and adequate cleansing of the hands. J. W. Brown, writing in the *Journal of the American Medical Association*, states that he believes that hand washing is possibly the most important single control measure in the control of cross infections. He recommends that the hands be thoroughly washed before any patient care and again after the care of each patient. The need for hand washing between contacts with the so-called "clean patients" should not be overlooked.

A quick dip in and out of the water does not constitute hand washing. The following suitable procedure taken from "Guide for the Prevention and Control of Infections in Hospitals" states:

1. Standing well away from the sink turn on the water to a temperature suitable for the hands.
2. Moisten hands and apply a heavy lather of soap, covering well beyond the contaminated area, Pay particular attention to the areas between the fingers and under the nails. (Toothpicks may be provided for cleaning under the nails.)
3. Use friction, one hand upon the other.
4. Rinse thoroughly under running water, allowing the water to flow from above toward the finger tops.
5. Repeat steps 2 and 4.
6. Dry hands thoroughly.

Hand washing facilities should be conveniently located to make personnel more conscious of the need for frequent hand washing. It is suggested that the sinks have foot or knee controls and mechanical soap dispensers. If the water supply is controlled by hand faucets, it is suggested that they be turned off with paper towels.

The hexachlorophene soaps are used much now to reduce the bacteria count on hands. When additional precautions are believed to be necessary, alcohol or a germicidal rinse are often used.

Hosp. Mgt., 91:38, March, 1961

Semen Storage

Bovine semen stored for as long as 6 years at a temperature of 320 F. below zero, and used for artificial insemination, after being reconstituted with a liquid diluent, has resulted in the birth of healthy calves according to American Breeders Service.

R. R. Dykstra, D.V.M.

Ethyl Alcohol, Ruminant Feed Additive

Ethyl alcohol as a feed additive for ruminant animals increased rate of cellulose digestion and improved urea nitrogen utilization in recent experiments conducted at the Rutgers University College of Agriculture. The basic research work by Werner Jacobsen was aimed at determining the nutritional significance of ethanol (ethyl alcohol) as a liquid supplement for ruminants.

Poor quality orchard grass hay, containing 6% crude protein and 35% cellulose, was used as a basic roughage during the 2 year Rutgers study. Fixed quantities of the ground hay were weighed into beakers, which contained rumen fluid collected from a fistulated cow and also artificial saliva. The beakers were capped, and fermentation was allowed to proceed. Ethanol and urea, working together, increased cellulose digestion beyond the additive effect of each of the 2 materials.

Ethyl alcohol, as a hydrogen donor, aids the metabolism of rumen microorganisms by lowering the oxidation-reduction potential. This enables the microorganisms to attack cellulose more quickly and to better utilize urea nitrogen to manufacture protein.

N. J. Agr., Jan.-Feb., 1960

Retention Suture For Hernia Repair

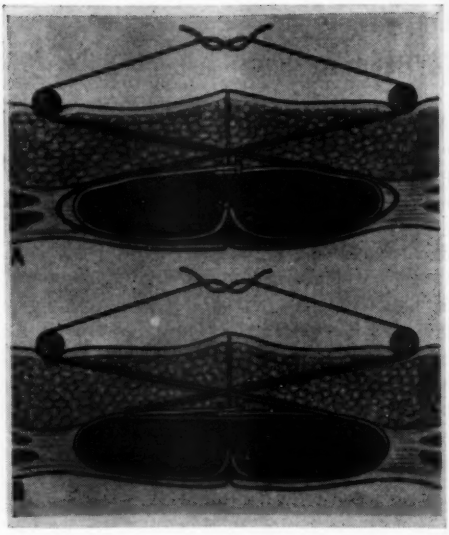
The difficulties and uncertainties of ventral hernia repair are shown by the wide variety of treatments advocated. To depend on foreign-body patches in hernia repair is to invite trouble and shows a lack of faith in basic wound repair.

Drs. F. W. Taylor and J. G. Jontz at Indiana University School of Medicine report on a method of using relief wound tension in repair of incisional hernias that utilize the "fixed figure-of-eight" retention suture. The principle is not new, but it has been so little recognized that the mechanical advantages have been disregarded.

Metal and plastic prostheses add strength to the incision but can not be removed. They remain as large foreign bodies. Removable retention sutures are used to eliminate this undesirable feature.

A crossed type retention suture or the figure-of-eight, as shown in the figure, will exert tension and also is removable. The tension is exerted on the opposite wound margin from a fixed point, thus holding the margins together. As shown in the illustration, the location may be varied to fit the situation. It may grasp the anterior fascia (B) or it may surround the entire muscle and fascial layers (A). Care must be taken to avoid strangulation of the muscle and to exert tension on the fascia. The sutures are placed at approximately 1 inch intervals. The retention suture should only grasp the fascia in the deeper sutures and should not pass through the peritoneum unless it is protected by the omentum.

In repair of hernias the figure-of-eight retention suture is only to relieve tension on the wound and protect it against excess tension that might cause recurrence. The retention sutures are left in for 2 weeks. After about 5 days they become quite loose, but their purpose is to prevent stress only when there is muscular movement. If they are fixed with excessive tension, they will cut through the fascia.



A. Fixed figure-of-eight type retention suture which mechanically bolts wound margins together. The lateral point in the skin suture is a fixed rack. With this type, care should be taken to avoid constriction of the muscle and not to enter the peritoneal cavity.

B. Variation of the suture, but including only the superficial fascia.

The newer synthetic sutures are more satisfactory than silk, cotton or linen. Wire has the advantage that it may be pulled taut and will stay in position while the wound is open and repair is effected. The disadvantage is that it is uncomfortable and more difficult to remove.

The figure-of-eight suture is fixed over some type of frame. A frame made of multiple sections of tongue blades placed transversely between adhesive, which in turn is wrapped in gauze and sterilized, is flexible but hides the wound and skin sutures for 2 weeks. Ethicon has a plastic bridge which is quite satisfactory. A type of device is needed that will exert only intermittent tension and at the same time provide exposure to the wound for care and observation.

Surgery, 48:528, 1960 (Sept.).

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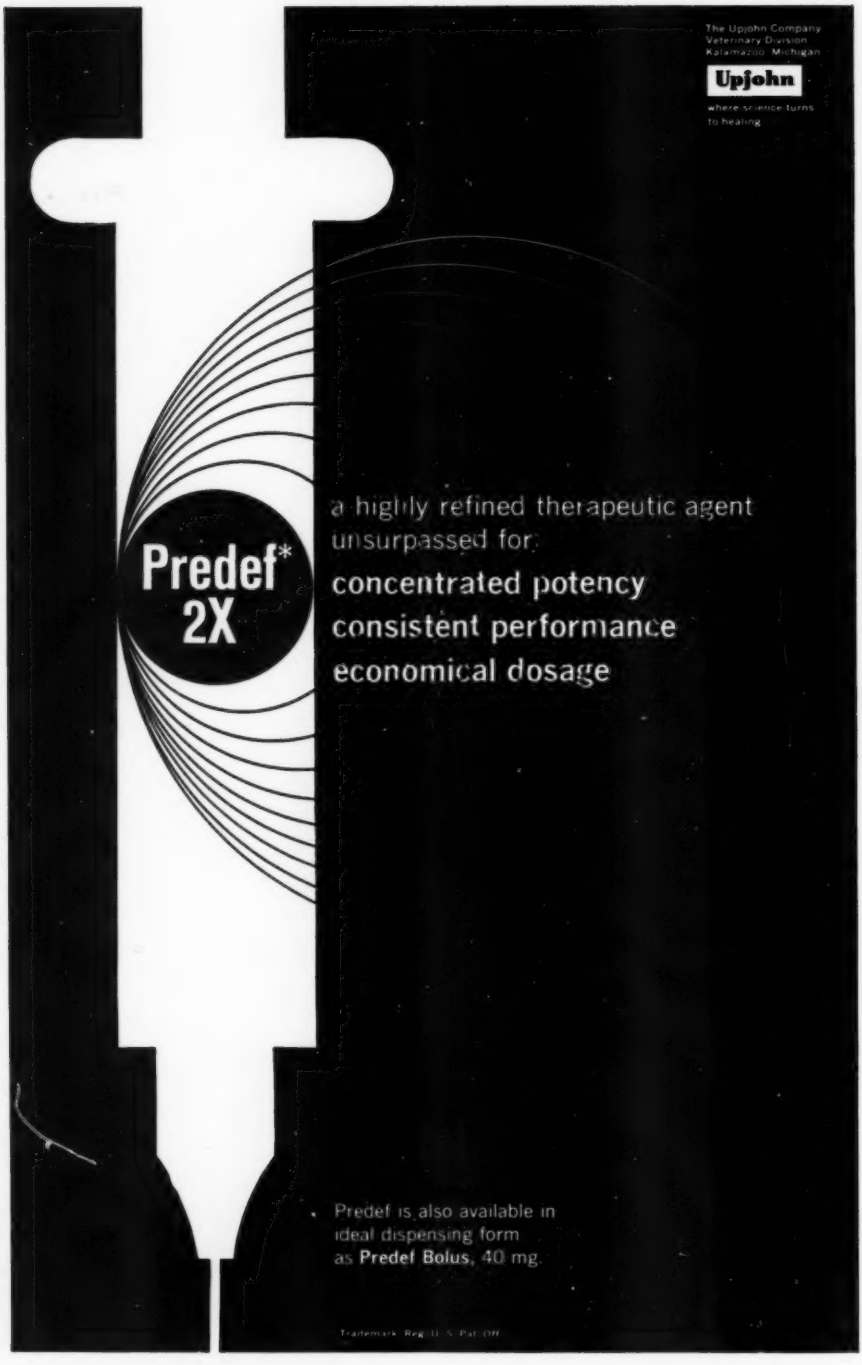
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